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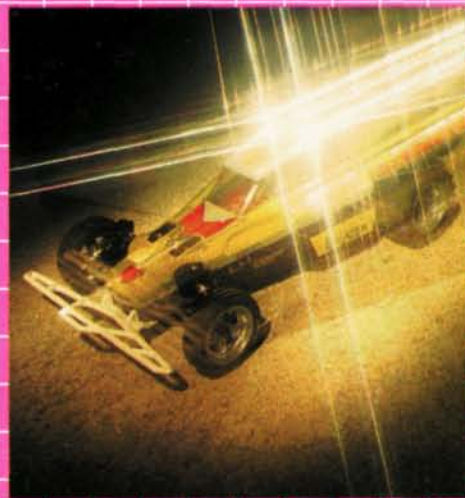
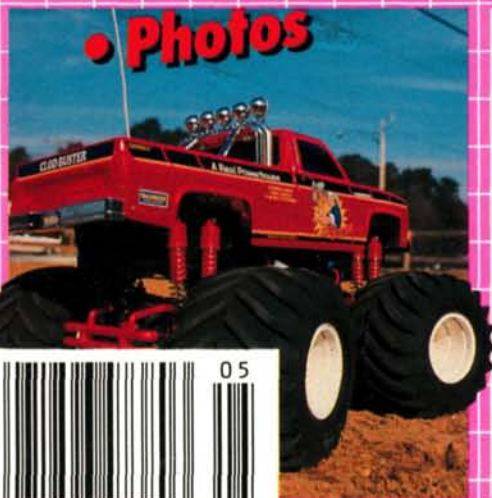
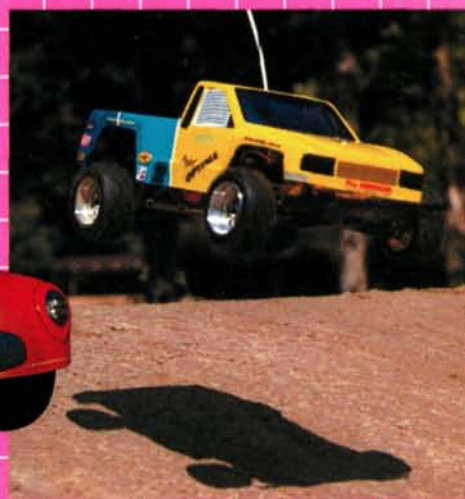
CAR ACTION

THE WORLD'S PREMIER R/C CAR MAGAZINE

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100
BEST

- Cars
- Bodies
- Accessories
- Drivers
- Pit Tips
- Photos





TEN BEST CARS pg. 36

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WHAT'S NEW



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TEN BEST BODIES pg. 48



PROJECT BLACKFOOT pg. 80

ON THE COVER: Clockwise from top left: Advance Engineering Custom Street Machine kit with '41 Willys body (photo by Steve Pond). Project Blackfoot (photo by Steve Pond). Project Optima in flight with McAllister Toyota body (photo by Louis DeFrancesco). Prototype 1/4-scale Raco Indy Car (photo by Steve Pond). Cosmo with Craft-Air light system (photo by Rich Uravitch). Hyperdrive belt system. Clod Buster (photo by Steve Pond).

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EDITORIAL

by CHRIS CHIANELLI



IN THE DAILY TORRENT of letters received, we're asked again and again, "What's the best?" It's difficult to answer this question, but we never ignore readers' requests. Inevitably, someone will be upset with our choices. We can't please everyone, so we'll try to please you, our readers. Ten slots aren't enough in some categories, and, no doubt, someone will feel left out. In many categories, the call was very close, and there were many contenders that, while being very strong possibilities, didn't quite make it.

Let's take a look at R/C bodies: Not only is there a profusion of bodies to choose from (so many of them beautiful), but also, by virtue of what's being selected, styling and personal preference obviously played a deciding role. Attention to detail, trueness to scale and originality of subject also counted heavily. When considering the 10 best after-market parts, ingenuity and track record were obvious criteria, but cost-effectiveness was also a consideration.

When selecting the 10 best cars, race performance was a big factor, but not the *only* one. If race results were the only important considerations, a car built in the cellar by an engineering genius for a handful of select drivers would have been our winner. We at *Car Action* decided that if you couldn't get it at the local hobby shop and with good parts support, we wouldn't consider it. The voting was carried out after much deliberation—and some *heated debate*, I might add. So here we go again, sticking our neck out by presenting you with *Car Action's* Ten Best For '89.

Last month, we told you we'd be bringing you "Clash of the Titans, Part II," and we soon will, I promise. Owing to a repeated part failure in one of the trucks, we've been forced to postpone the second part of the test, but we'll soon bring you a comprehensive report. I apologize!

Now all I have to do is go explain this to the Ayatollah of Radio Controlla. See you next month—I think!!

LETTERS

WHERE TO WRITE TO US

If you're writing to the editors (and we'd love to hear from you), please be sure to address your letters to "Letters," *Radio Control Car Action*, 251 Danbury Road, Wilton, CT 06897. Only subscription orders and inquiries are handled by our Customer Service Department in Mount Morris, IL; other mail addressed there must be forwarded to Connecticut, which leads to long delays.

May Eagle Eye

I think I found the Eagle Eye picture on page 130 in the March '89 issue. The top picture is, no doubt, a Frog, but the motor is on the opposite side of the gearbox, and the servos are in the wrong place. One more thing: Could you do an "SLS" on the Blackfoot? You people are great; keep up the good work. Thanks.

DAVE DODD

Middletown, NY

Congratulations Dave, yours was our eighth correct response. You'll be receiv-

ing a free set of Car Action decals. Check out our "Second Look Series" on the Blackfoot in the April '89 Monster Truck Special.

Cheap Chassis

Some friends and I decided to use graphite chassis until we noted the expense. So we decided to look for a material that was durable, lightweight and inexpensive. A helpful dad introduced us to a material made of Pyrex and fiberglass, which is the material used on the front of stoplights. We cut it in the shape of an RC10 chassis and bolted it on. After we'd mounted the radio equipment on the chassis, we tried it out. Unfortunately it was a cold, snowy day and we had to run it in a friend's basement. The

car took off a little faster than normal, but it wasn't able to reach full speed. I still don't know how this chassis will work out for off-road use, but I'm optimistic. The prototype chassis was more rigid than a friend's graphite chassis and it weighed less. We think the chassis is a winner. Do you?

BRIAN BLOHM

*President, Hip Chicken Racing Team
Member Glenbrook South High School
R/C Car Club
Glenview, IL*

Brian, it sounds good, but I'd appreciate it if you could give some more info on what it is and where to get it, so we can test it here at Car Action.

CC



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Any Will Work

I love your magazine. I think it's the best. I'm 12 years old and I have an MRC/Tamiya Avante. I read the track report on the Avante in your September '88 issue. The person who wrote it used a PDI computerized Pro Zeta speed control. Is it necessary to use a speed control? He also used a Futaba Magnum Jr. radio. Is there a less expensive radio (under \$70) that would work just as well with my Avante?

BEN KNAUS
Minneapolis, MN

Ben, I assume in your question, "Is it necessary to use a speed control?" you left out the word "electronic." There's no reason you couldn't use a mechanical type while you're saving up for an electronic

controller. The PDI Pro Zeta is a high-quality, advanced electronic speed control that I recommend without reservation, and the Futaba Magnum Jr. has a track record that speaks for itself. However, the Avante, like any other car of good quality, will take virtually any radio gear and speed controller on the market, including the less expensive models, and, assuming you've properly installed the equipment, positive results are assured.

CC

1/10-Scale 1/4 Mile

I found an error in your mag (the best in the world) on page 136 in the February '89 issue. Since the Midnight Pumpkin is 1/12 scale, the 1/4 mile should be exactly 158.4 feet, not 132 feet. By the way, is the Road

Wizard 1/10 or 1/12 scale?

BRYAN MATTEM
Alpharetta, GA

Bryan, a full-scale 1/4 mile is 1,320 feet, so a 1/10-scale 1/4 mile is 1,320 divided by 10 (132 feet). I suspect you divided 132 feet by 10 and then multiplied by 12. You should have divided 1,320 feet by 12. A 1/12-scale drag strip should be 110 feet. You zigged when you should have zagged. The Tamiya F-1 car, almost identical to its predecessor, the Road Wizard, is 1/10 scale. It's smaller than, say, a 1/10-scale stock car, because the full-scale F-1 and Indy cars are quite small compared to full-scale stock cars.

CC

(Continued on page 10)



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LETTERS

(Continued from page 9)

We Hit the Frog on the Head

Thank you for the great magazine. It's truly a pleasure to find *Car Action* in my mailbox every month. Please also extend my thanks to the people in charge of your graphics and layouts. Being a former printer/layout person, I've learned to appreciate such things, and yours are tops!

Boy, you guys hit the nail right on the head in your "Return of the Frog" article (Mar. '89). I've been having gear-box trouble since day one with my Frog, so your suggestion for the ball-type differentials is a really good one. However, I'm not sure how they work and what maintenance they require. I've also heard that you can "tune" them. Does this have to be done with all ball differentials, or is this more of a "track-specific" adjustment?

Also, I've been interested in a body change for a street-rod look for my Frog, but I've run into a couple of problems. One is that the wheelbase is too short to fit the Parma Ford Ranger body I picked out for it. Is there anything that I can do to lengthen the wheelbase, or will it be easier to raise the body and make it a monster truck? Also, is there any way to fit wider street tires on the front? I noticed in your issue on street rods that you had a Tamiya Hornet with some aluminum slotted wheels that were really sharp.

I'd really appreciate some help.

RICH GOETSCH
Westerville, OH

Rich, we honestly do our best to give the most accurate information we can. We know it's the only way to keep readers turned on to the hobby and loyal to *Car Action*. Thank you for that loyalty. The ball diff can be tuned "track specific" as you put it, which is one of the advantages to these units. The two diff rings (also called the pressure plates) that the ball-bearings ride between can be tightened or loosened. They can be tightened down so much that you can virtually lock up the diff to give posi-traction with no differential action. On the other hand, they can also be loosened up to act as a slipper clutch. Correctly

adjusting the ball diff to the track surface has made the difference between winning and losing.

At this time, I'm not aware of any way to lengthen a Frog, so raising the body monster style would be the answer. Also, the vast number of bodies vary in wheel-base dimension, so you might try some other body. Many companies, like Bru-Line and Advance Engineering, make wider rims for the Frog, and Imex makes some great Eagle-type road tires to fit these rims.

CC

10 Points for Associated

I think your magazine is excellent; the photography and layouts are the best, and the car reviews showing pro and con opinions are very informative.

I'm writing to thank Associated Electric for the tremendous assistance they gave me after I purchased an RC10 kit from an unscrupulous dealer. Most of the rear-end parts were missing from the kit (the box had been opened), and for over a year I waited for the dealer to obtain the parts. Finally, I called Associated and they were shocked to learn of this. They sent the parts directly to me, and the car is now running, thanks to their help. It's nice to know that help is only a phone call away.

ROBERT G. ROY
Saint John, NB

Robert, you're lucky you chose a product from a company with an excellent customer-service policy. In the future, check the factory seal on the box. Not all manufacturers provide a seal, although it's obviously a good idea.

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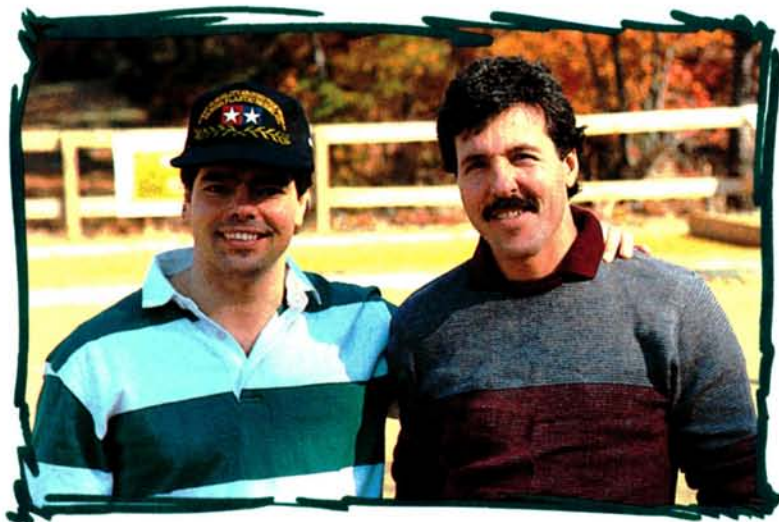
RC10 Oil Filter

I'm hoping to be the eighth person to find this month's mistake. I found one on page 28 in the Jan '89 issue: The RC10 pictured in the lower left-hand corner has something other than your standard motor—at least, I think so. My RC10 doesn't use a Fram oil filter.

(Continued on page 14)

PUBLISHER'S PAGE

by LOUIS DeFRANCESCO



Publisher Louis DeFrancesco pictured with Frank Ritota at one of MRC's Race Day Series. Frank is VP of Technical Operations at MRC and has been with them since 1973.

WHILE TAKING ONE of my daily runs at the local high school's track-and-field area, I happened upon a group of kids running R/C cars and monster trucks. They had turned a baseball diamond into a makeshift track and were really going at it. An older brother's Jeep was recruited to take care of battery-charging duties, and a small crowd gathered to witness the spectacle. What was so unique about this scene? Nothing. This could be anytown USA, and we must remember that it's these youngsters who make up the vast percentage of our hobby/sport. Sometimes, we get too caught up in the competition and which is the fastest high-tech car, etc. Not all modelers have access to a track or the bucks for the really competitive machines and equipment. It's these kids who are the real backbone of our hobby and the future of it. This is one of the reasons why so many of our articles are for them. Let's not forget them.

The good old boys who run the Peach Bowl Speedway down in Atlanta, GA, asked me to be part of the 1989 Paved Oval Champs that will be held this upcoming Memorial Day Weekend. The Peach Bowl Superspeedway is one of the premier tracks in the country, and this promises to be quite an event. You know what they say about Southern hospitality, so we'll be part of it. Paved-oval racing is really growing, and if you're down that way around Memorial Day, you might want to check out the action. See you next month. ■

R/C Staff Needed

Boys' camp in the North Carolina mountains needs staff for a remote-control car, truck and boat training and racing program, June through August 1989.

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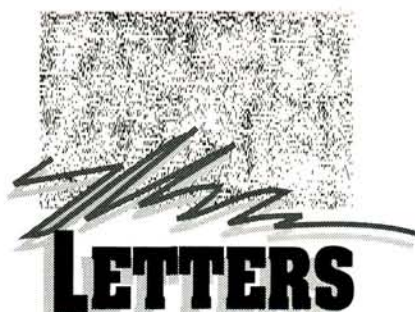
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(Continued from page 10)

Thanks for such a high-quality magazine.

TODD HOLLOWAY
Yorktown, IN

Todd, where have you been? All '89 RC10s come with Fram oil filters, carbon-fiber freznel tubes, window washers and full-race dip-stick. Where have you been?

CC

We Tell The Truth

I'm very enthusiastic about R/C cars—always learning about the cars, setting them up, repairing them, etc. I decided to try my hand at on-road cars, so I bought a C&M Cobra. (I'd learned about it from a track report in the Nov. '88 issue of *Car Action*.) I used almost the same setup—a Novak speed control instead of a Victor, and the McAllister Pontiac '88 NASCAR body instead of the MRP GTP Corvette body; and I'll tell ya, it runs great! Thanks a lot for introducing me to on-road racing with this beauty! Also, my thanks to C&M Mfg. As your track report said, "C&M claims it's an out-of-the-box winner—no need to modify," and so it is!

Thanks a lot! Your magazine is the greatest! Please send me the address of CRP.

JUSTIN HOLOBER
Miami Lakes, FL

Justin, we're simply doing our job, reviewing products as honestly as we can. Thanks. By the way, CRP's address is 3250 El Camino Real B-3, Atascadero, CA 93422.

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READERS' RIDES

Welcome to "Readers' Rides"! We continually receive photos of readers' latest projects, so we've decided to start featuring some of the more innovative stuff to give all our readers a glimpse of these neat cars and trucks, etc. So here we go! If you want to be part of this new feature, send us a nice color photo of your project with a brief description, and we'll show it to the Ayatollah of Radio Controlla at the next editorial meeting to see if he'll publish it!

If we publish your photo, we'll give you a one-year subscription to RCCA, or extend your existing one, and you'll even be eligible for our "Readers' Rides Car of the Year Contest" in the fall of '89. Send your photos to Readers' Rides, R/C Car Action Magazine, 251 Danbury Road, Wilton, CT 06897. Start clickin', shutterbugs!

Five-year-old Corey Passmore of Winchester, IN, is shown here with his new Kyosho Raider. His Raider is stock, apart from a set of ball bearings, but Corey claims, "This baby's awesome!" Corey's dad, Eric, who owns a Kyosho Rocky, was also bitten by the R/C bug. Dad built a track in their back yard for the two of them to race on! Don't you all wish you had a dad like that?!



This sharp-looking RC10 is owned by Bruce Hadella of Great Falls, MT. Bruce's RC10 features a Composite Craft narrow graphite chassis, a Novak 1X speed controller, a Futaba radio system and a Twister stock-class motor. Great photo, Bruce. (He's a photographer by trade; don't try this shot at home!)

This awesome-looking Bruiser is the handiwork of John Rathjen of Honolulu, HI. Among John's many modifications are a set of Clod Buster tires mounted on custom machined-aluminum wheels, a steering stabilizer, a front skid plate, re-arched leaf springs and a body lift to fit the larger tires, kicker traction shocks on each wheel, a rear-axle truss and an extended front drive shaft. These are the modifications you'd find on many full-scale custom 4-wheel drives. Great job, John!



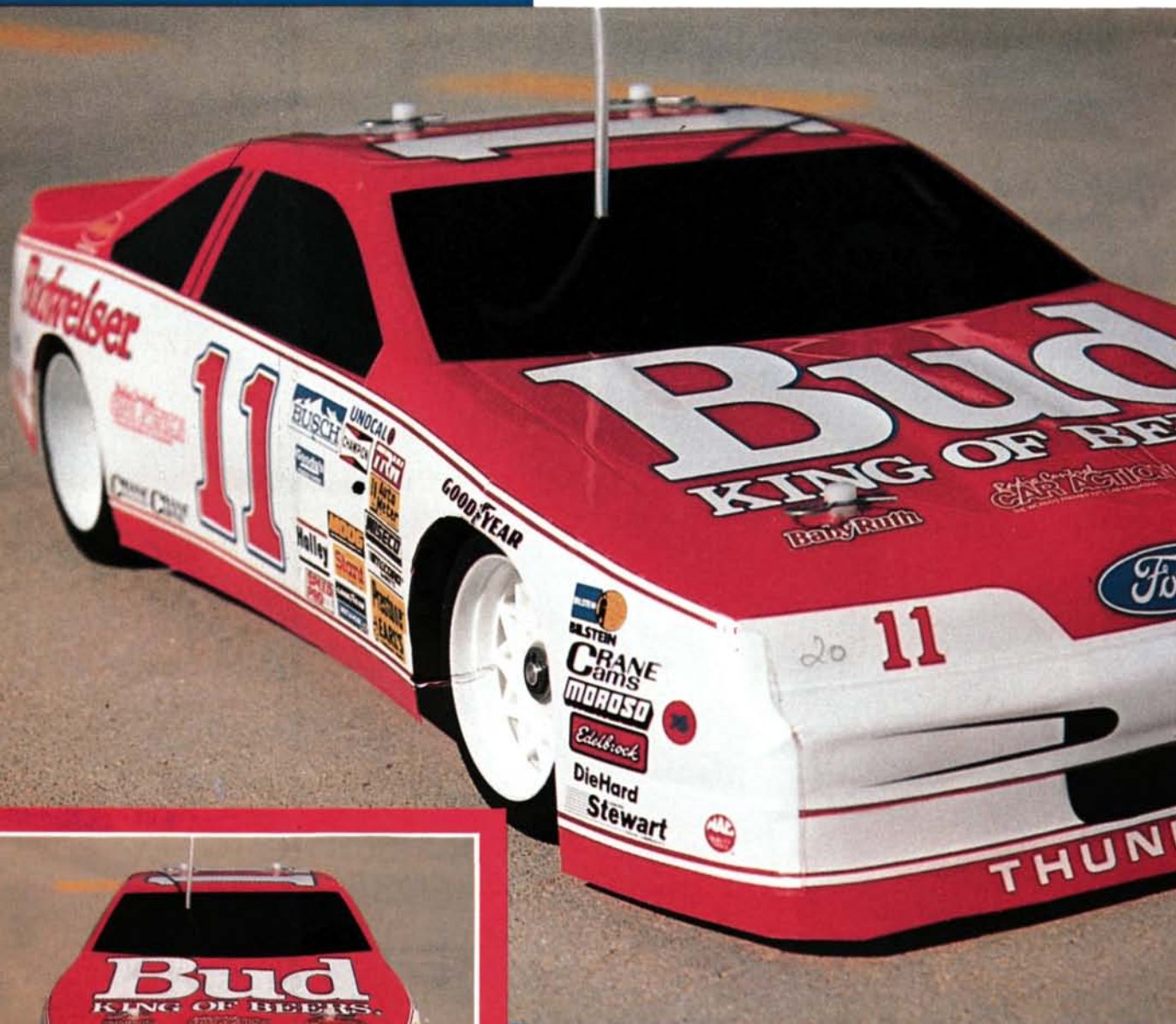
Terry Swain, of Palm Bay, FL, sent us this picture of his beautiful Pacesetter Vaporizer, which features a methano-burning Quadra Q50, M/T all-rubber drag slicks, J/V headers, a Simpson drag chute, 6-to-1 gear ratio, and, to put the finishing touches on the package, a sparkling blue metallic paint job with the name "Show Time" radiating from the side panels.

TRACK REPORT

THIS ONE'S FOR YOU!

by FRED L. BEAVER

JUNIOR JOHNSON HAS been involved in NASCAR racing for nearly four decades: first as a driver, then as a car builder, owner and crew chief. It has been over 20 years since he hung up his helmet, but he's still listed in 7th place in total victories. From 1971 up through last season, Junior had been campaigning cars exclusively from General Motors. In 1988, driving a Chevy Monte Carlo, driver Terry Labonte took the team to a respectable



4th-place finish in the standings.

On October 9, 1988, just before the start of the Oakwood Homes 500 at Charlotte Motor Speedway, a covered car was mysteriously rolled out to the start/finish line. With the assistance of Ford's Special Vehicle Operations (SVO) Director, Michael Kranefuss, owner Junior Johnson removed the cover. There, before a stunned crowd, rested the new No. 11 Budweiser stock car, but it wasn't a Chevy, or even a Pontiac, an Olds or a Buick. After 18 seasons

with GM, Junior had switched to a *Ford*!

Junior knows a good thing when he sees it, and the swoopy lines of the new Thunderbird promised to be the hot ticket for '89. Model Racing Products* apparently know a good thing when they see it, too, for

within weeks of the unveiling of Junior's new car, the company had introduced a very accurate 1/10-scale version. Believe it or not, this is an official product of Anheuser-Busch, the makers of Budweiser. Like MRP's



MRP

BUDWEISER

S T O C K C A R

offerings, NASCAR racing and Budweiser beer are home-bred and home-brewed, and to reinforce the point, MRP puts a "Born in the USA" sticker on each kit's box.

THE KIT: MRP offers two versions of this car: one complete and ready to run with Aristo-Craft* Challenger radio gear, and the other *without* radio gear. Those who elect to install their own radio gear (using the supplied double-sided tape) can easily complete the car in a short time by following the very thorough, yet simple, instructions. You'll need to know how to do light soldering if you elect to use the stock speed controller to provide power for the receiver with a Ni-Cd battery pack; otherwise, no special tools or skills are needed. You'll find that some tie-wraps and additional double-sided tape will come in handy during assembly.

ASSEMBLY: The Thunderbird body is already painted red with the wheel wells cut out and the holes for the body mounts and antenna pre-drilled. To help you complete the detailing, a very large sheet of multi-colored pressure-sensitive decals is supplied. When it's finished, no other off-the-shelf, on-road car can beat this one in the looks department. For those who already own an on-road car and are green with envy, the body and decals *can* be bought *separately*, and if you can justify the expense, a set of after-market aluminum mags would make the car look even better.

The chassis is a stripped-down MRP GP-10 fiberglass version con-

Above: All decked out in Bud colors, the MRP Stock Car looks like it came straight from the Daytona 500.

Left: The MRP Budweiser Stock Car is almost ready to run out of the box. You don't even have to paint the car, just apply the decals.

MODEL RACING PRODUCTS

BUDWEISER STOCK CAR

Type: On-road racer
Scale: 1/10
Sug. retail price: \$169.95
 (w/o radio)

DIMENSIONS:

Overall Length: 18 inches
Width: 9 inches
Height: 4.5 inches
Wheelbase: 10.25 inches
Front Track: 7.75 inches
Rear Track: 6.80 inches

WEIGHT:

Gross (w/bat.): 47 ounces

BODY:

Type: '89 Ford Thunderbird
Material: Polycarbonate

CHASSIS:

Type: Pan w/T-plate
Material: Fiberglass

DRIVE TRAIN:

Type (pri./sec.): Pinion/Spur gear
Differential(s): Ball type

SUSPENSION:

Front: Type: A-arms
Dampening: None
Rear: Type: T-plate
Dampening: None

WHEELS:

Front: Type: Nylon spoked
Dimensions: (DxW) 2x1
 inch
Rear: Type: Nylon spoked
Dimensions: (DxW) 2x2
 inches

TIRES:

Front: Sponge rubber
Rear: Sponge rubber

ELECTRICS:

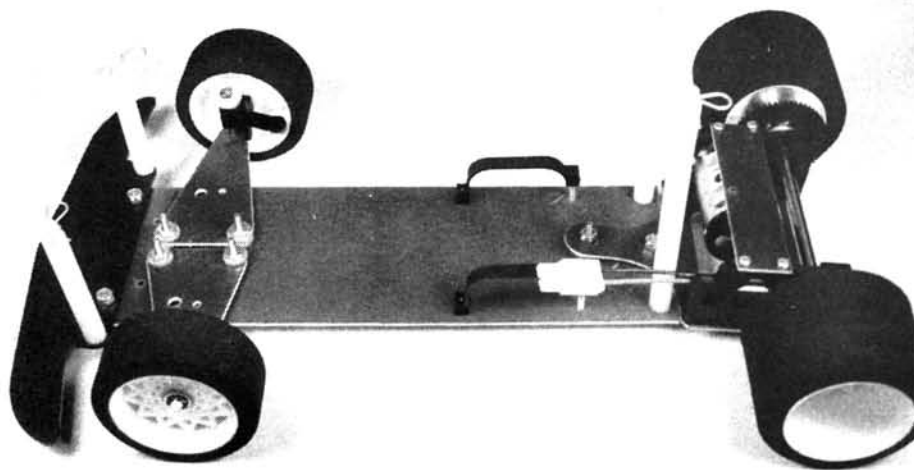
Motor: Mabuchi 540
Battery Req'd.: 6-cell stick pack
Speed Controller: Wound resistor

OPTIONS AS TESTED:

Futaba Magnum Junior with two FP-S148 servos

COMMENTS:

Since the chassis comes almost assembled, the MRP Budweiser Stock Car can be up and running in just a short time. This is strictly an entry-level kit, and it will require major hop-ups for serious racing.



They don't get much more basic than this, and that's why it doesn't take long to get the car running.

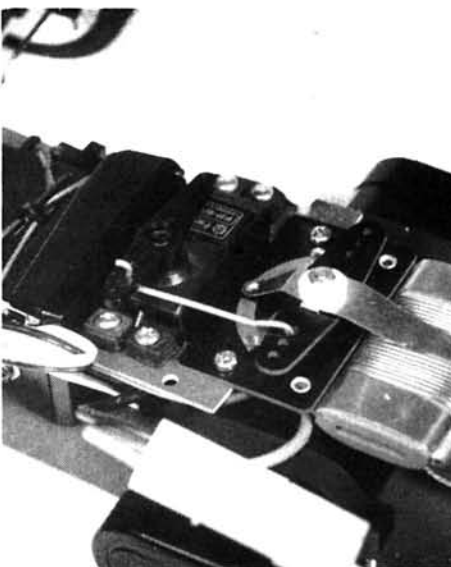
sisting of a single pan with the drive train mounted on a T-plate. The front end utilizes metal kingpins and plastic spindles mounted on fiberglass lower A-arms. Both the T-plate and the A-arms are isolated at their attachment points by rubber washers.

There are no coil springs or shock absorbers, and dampening is accomplished primarily by the flexing of the chassis components. This is about as basic a chassis and suspension system as you can get! Don't be fooled by its simplicity, though, as the chassis can be set up to handle well under most conditions. Up front, the camber, caster and toe-in settings can all be adjusted. Camber can be added by loosening the shoulder nuts at the end of the A-arms, or taken out by tightening them. Caster can be added by placing additional washers under the front of the A-arms. Note that changes in either of these settings will affect the ride height. Toe-in can be decreased by using a pair of needle-nose pliers to kink the piano wire that connects the spindles. You should set up the car so that there's little, if any, toe-in. In the rear, the nuts for attaching the T-plate can be tightened or loosened to decrease or increase flex and change the ride height. Using a spacer of a different size under the forward T-plate attachment screw will also lower or raise the ride height.

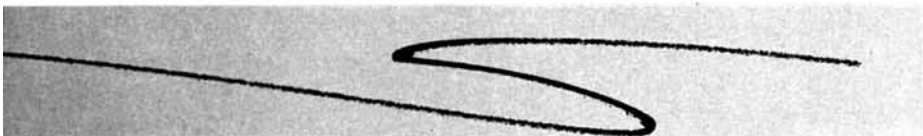
Ideally, to keep the center of gravity down, the chassis should sit as low as

possible without bottoming out or adversely affecting the handling. Getting the body close to the track also keeps aerodynamic drag to a minimum. The body can be lowered by removing the mounting posts and filing the ends a little at a time until the car starts to scrape the track on bumps, or to interfere with the tire clearance.

MRP offers an optional chassis upgrade kit that includes an upper radio tray, front springs, and aluminum hydraulic monoshocks for the front and rear. Also of-



A wound resistor speed control sits above the 6-cell battery pack. This system works well for an entry-level car.



ferred are a ball-bearing kit and adjustable tie-rods. These upgrades are highly recommended if you're entertaining any thoughts of seriously racing this car.

The Mabuchi 540 motor and steel rear axle are attached to the T-plate with two plastic uprights. An 11-tooth metal pinion gear turns a hard plastic 56-tooth differential spur gear to get the power to the ground. In the ball differential, slip is adjusted by tightening or loosening the nut holding the right rear wheel on the axle.

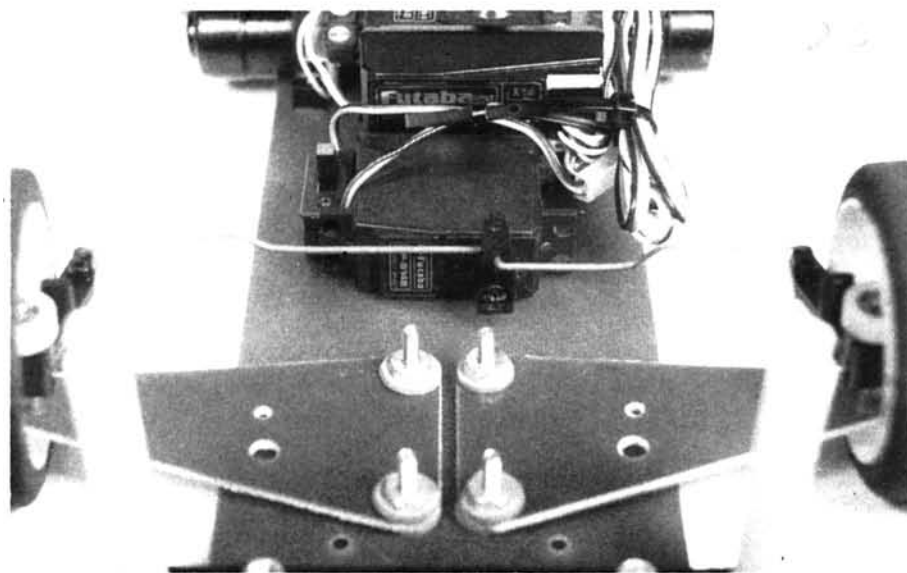
On-road cars must be run on smooth, hard, surfaces like concrete or asphalt, and these cars are *really* at home on specially designed tracks, e.g., the Spring Cove Speedway near Florence, AL, where the test sessions were held for this article. The track is patterned after the full-size tri-oval Talladega International Speedway. Its outside perimeter is over 360 feet, and it has a 90-foot front straight. The corners and back stretch are steeply banked for maximum speed. Since the track is tucked away several miles off the nearest main highway, first-time visitors should contact the owners, Chuck and Lyda Sypolt, at (205) 757-5998 for specific directions.

PERFORMANCE: When run straight out of the box, with no adjustments except a decrease in toe-in, the car exhibited mild, but controllable, oversteer in the corners. On the straights, the car tended to wander slightly, with looseness in the front end being the culprit—a problem

curable by the installation of ball bearings. Although it's a very good unit for its type, the stock-wound resistor speed controller would drop the power rather abruptly any time the throttle was lifted, and this made smooth transitions from the straights to the corners difficult. Speed, though fast compared to a stock off-road car, and more than enough for a novice driver, is way *below* that which a full-bore competition car requires. A gear change would add speed, but the suspension would then be pushed to its limits. In addition to the upgrades mentioned earlier, anyone who wants to race this car will need, at the very minimum, a hotter motor, an electronic speed controller and an assortment of different pinion gears.

With the basic kit, MRP starts you off with a great-looking up-to-date aerodynamic body mated to an uncomplicated chassis and also a good motor and speed controller. You can add any radio gear and beef up the car with optional parts and a faster motor if you want to. This way, the car appeals to both beginners and experienced drivers. One thing's for sure: No matter what your skill level, taking the MRP Budweiser stock car out for a spin is sure to brew up some excitement!

**Here are the addresses of the companies mentioned in this article:*
MRP, 18676 142 Ave. NE, Woodinville, WA 98072.
Aristo-Craft, 396 Bergen Ave., Jersey City, NJ 07304. ■



Don't make this mistake: Always use a servo-saver to protect your steering servo, unless you enjoy replacing tiny gears.

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Blackfoot

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Big Grizzly

The Fox

Ultima

Big Brute

COMING SOON:

Lunch Box

Clod Buster

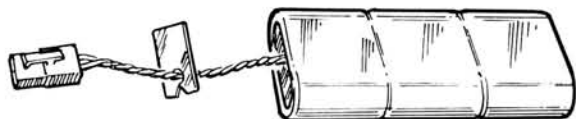
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PIT TIPS

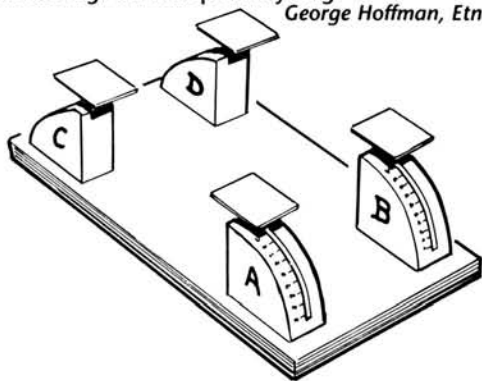
by JIM NEWMAN



BATTERY TAGS

Save the colored plastic tags used to tie bread wrappers, etc. This reader uses them to show the state of his battery packs, e.g., green for "charge" and red for "flat." Snap the tags over the leads as shown. He says you can also use marker pens on them, as they can be wiped clean, and he stores the tags on a snap-on key ring.

George Hoffman, Etna, ME



CHASSIS BALANCING

This contributor is a member of the full-scale Winston Racing Team, and he recommends that you always balance the car to suit the track. He uses inexpensive calorie-counter scales glued to a flat board, then he sets the car on the scale pans. Each scale indicates the weight carried by that particular wheel, so A+B+C+D is total weight or, A+B is weight on front wheels, or B+D is weight on left wheels, etc. Keep an accurate chart: name of track; weight details and balance setup; lap times for that setup; motor type; battery number; gear ratio, etc. Soon you'll see improvements.

Robert Clark, Johnson City, IN



TRANSMITTER STOPWATCH

This would be useful with Bob Clark's idea. Stick an inexpensive digital stopwatch on your transmitter case, and use it for lap timing or recording battery time—important with a BEC.

Dan Amrhein, Batesville, IN

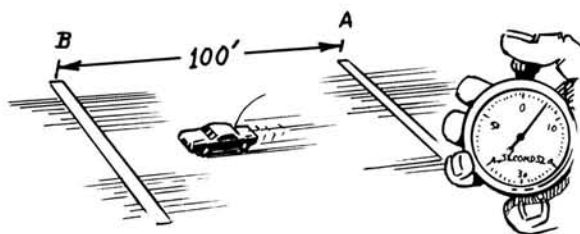
Radio Control Car Action will give a free one-year subscription (or one-year renewal if you already subscribe) for each idea used in "Pit Tips." Send rough sketch to Jim Newman, c/o Radio Control Car Action, 251 Danbury Rd., Wilton, CT 06897. BE SURE YOUR NAME AND ADDRESS ARE CLEARLY PRINTED ON EACH SKETCH, PHOTO AND NOTE YOU SUBMIT. Because of the number of ideas we receive, we cannot acknowledge each one, nor can we return unused material.



EASY PLUG ACCESS

This RC10 owner cut away the screen from one side of his car. This allows the battery leads to hang out through the window until he's ready to race, and then he plugs them together and stuffs them back inside.

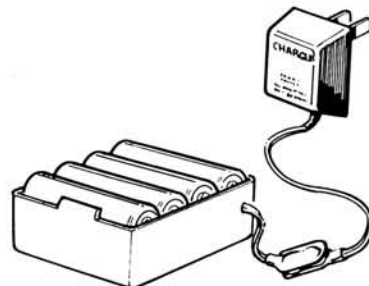
Steve Forman, E. Amherst, NY



SPEED TRAP

Want to know the speed of your car? Make two easily visible lines across the track about 100 feet apart. Station a stopwatch operator midway between them, then take a good long run at them for a "flying start." Start the watch as the car hits the first line, and stop it as it crosses the second one. Here's how to calculate your speed: 100 feet divided by time taken in seconds; then multiply the answer by 0.68 to arrive at mph. $\text{mph} = \text{distance covered (feet)} \div \text{time taken (seconds)} \times 0.68$ You can use a pocket calculator!

Doug Beverage, Nepean, Ontario, Canada



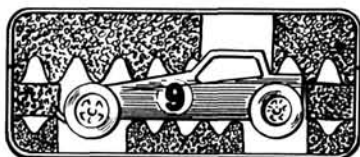
BATTERY CHARGING

Here's a case where the R/C'er changed from using dry cells in his transmitter to regular Ni-Cds, but since the transmitter wasn't equipped with a charge socket, charging the Ni-Cds was a problem. The solution was a Radio Shack, 8-cell battery holder, which came ready wired with the usual press-stud-type connector. The mating half of the connector was soldered to the charger leads. For charging, the cells are lifted from the transmitter, placed in the battery holder and connected to the charger. If an 8-cell holder isn't available, two 4-cell holders can be wired in series.

Robert Meisenger, U.S. Embassy, APO

PIT TIPS

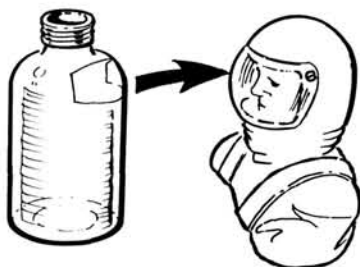
by JIM NEWMAN



SHIPPING CASE

Going on a plane? Pack your car this way, and safely check the bag. Take one old suitcase and fill it with egg-crate foam sponge. Cut out slots for the wheels, so that the pan rests on the foam, then place foam blocks at each side and both ends of the car. Now you can cut out slots for your charger, parts and small tools. This car has safely traveled many times.

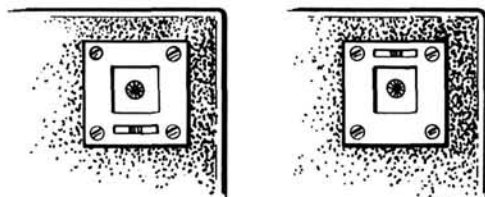
Richard K. Thackerson, Irving, TX



MOLDED VISOR

Find a crystal-clear plastic bottle and, from the shoulder, cut out a realistic bubble visor. Attach it to your driver's helmet with a couple of very small screws.

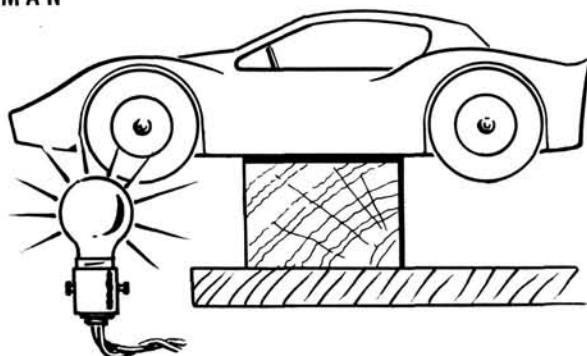
David Wright, Warner Robins, GA



SERVO-REVERSING

Mitch uses an inexpensive two-stick transmitter to control his cars, and if servo-reversing becomes necessary, he doesn't mess with switching servo wires. Instead, he removes the four screws from the appropriate transmitter-stick assembly and rotates the whole stick 180 degrees before replacing the screws. (Note the position of the trim levers in the sketches.) Mitch says some brands of radios might have screws inside, so you'll have to remove the back to gain access to them.

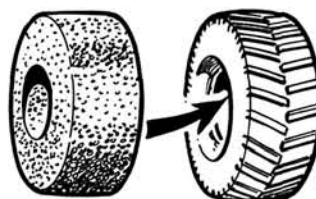
Mitch Poling, Seattle, WA



MARKING MOUNTING HOLES

While mounting a new, already painted Lexan body, this car owner had difficulty seeing where to drill the body-post holes. He hit on the idea of shining a bright light upwards from below the body. This cast a shadow of the posts that could be seen from above, thus enabling him to mark and drill the holes.

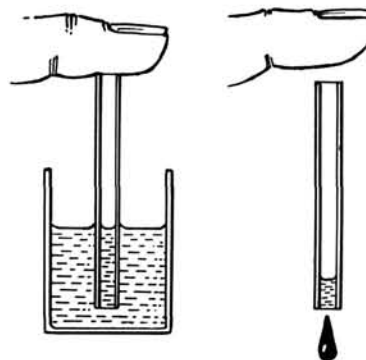
Bill Stebbins, Louisville, KY



TIRE INSERT

If your monster truck tires aren't firm enough for your needs, cut out thick, sponge-rubber "doughnuts" and stuff them into each tire. Sponge or foam plastic is easily cut with an electric knife or a band saw.

Ben Maddox, APO, Seattle, WA



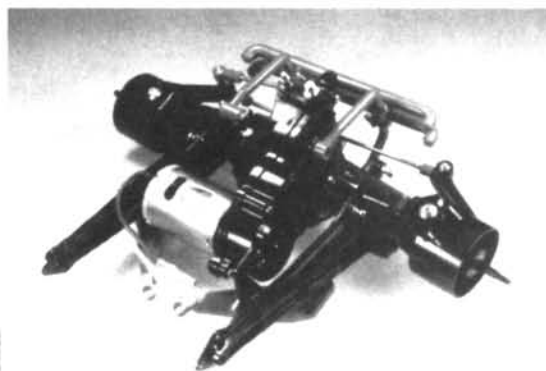
OIL DIPPING

Many drivers use regular automotive SAE 20W-50 oil in their shocks, but it's difficult to get it out of the deep container. Put a drinking straw into the oil, then put a finger across the top to seal it. Now lift out the straw, place the end in the top of the shock, and remove your finger. This will allow the oil to run out of the straw and into the shock cleanly—no mess!

Jan Young, Unionville, Ontario, Canada

DIRT DIGEST

by BILL O'BRIEN and BOB KANE



This front drive/suspension unit is fully assembled and ready for installation in the Clod Buster. At a glance, it's difficult to tell the ends apart.

CLOD BUSTER STEERING PROBLEMS

THIS IS A GREAT month: we got fan mail! Actually, it's gripe mail about a Clod Buster, and since we were going to include that truck anyway, we might as well get right to it.

Clod Busted

You guys are my last hope! I have a problem with the steering on my Clod Buster. The Clod is supposed to have 4WS, right? When mine's going, only the rear wheels do the steering; the front ones just stay straight. But when I pick it up, both front and rear wheels steer. I've tried everything I possibly could, from adjusting the steering springs (both tightening or loosening them) to adjusting the tie rods, but I

haven't had any luck yet. Could it possibly be my steering servo? I'm using the Challenger 2PX radio with HS-402X servos.

The people at my local hobby shop didn't really want to help me.

*Bart Drelichowski
Westfield, MA*

Bart, we hear a lot about "local hobby shops" that refuse to help customers, and I think it's a good way to go out of business. Even if you didn't buy the Clod at this shop, it's very short-sighted of the proprietor to refuse to help you. If you *did* buy your Clod Buster at the same store that refused to help, it's definitely time for the financial guillotine! (In R/C, money

dictates policy, customers spend money, and there's more money in repeat business.)

On to the problem: The Clod Buster has, perhaps, one of the most sophisticated assembly procedures (i.e., it's a little difficult to build) of any of the current crop of monster trucks. And in a few crucial areas, the manual isn't as clear as it could be. For example, setting up the front and rear steering actuators (part B2) is covered on page 16, and it isn't obvious that, with the wheels of the differential assembly facing toward you and the support arms facing away from you, the steering actuator arm for the front diff angles to

(Continued on page 30)

your right, and the arm for the rear diff angles to your left. Essentially, when finally assembled, both actuators are on the same side of the truck.

This setup gives the Clod Buster opposed steering, i.e., when the front wheels turn left, the rear wheels turn right, and vice versa. If you set up the actuators so that they face *opposite* sides of the car, the crab steering that results will stress the

it can be hazardous to your servo to turn the wheels while the truck is standing still.)

Another soft spot in the instructions relates to the amount of tension you should place on the steering springs (BR2). With as little pressure as possible, tighten the nut (BC2-3mm) until you feel resistance, then give it a few more turns until the tip of the screw just starts to poke

make up a shock resistor for the steering assembly, and the front and rear should both be tightened within a quarter turn of each other.

As for your 402X servo, Aristo-Craft rates it at 42 ounce/inches of torque. That's plenty for the Clod Buster, if the rod setup is correct. Our friend Charles uses them in his Clod Buster and about the only deviation he made from the instructions was to relocate the tie rod to the outermost hole of part B6 (for both the front and the rear), instead of the center hole as shown. This gave the rod a slightly longer throw and more articulated steering.

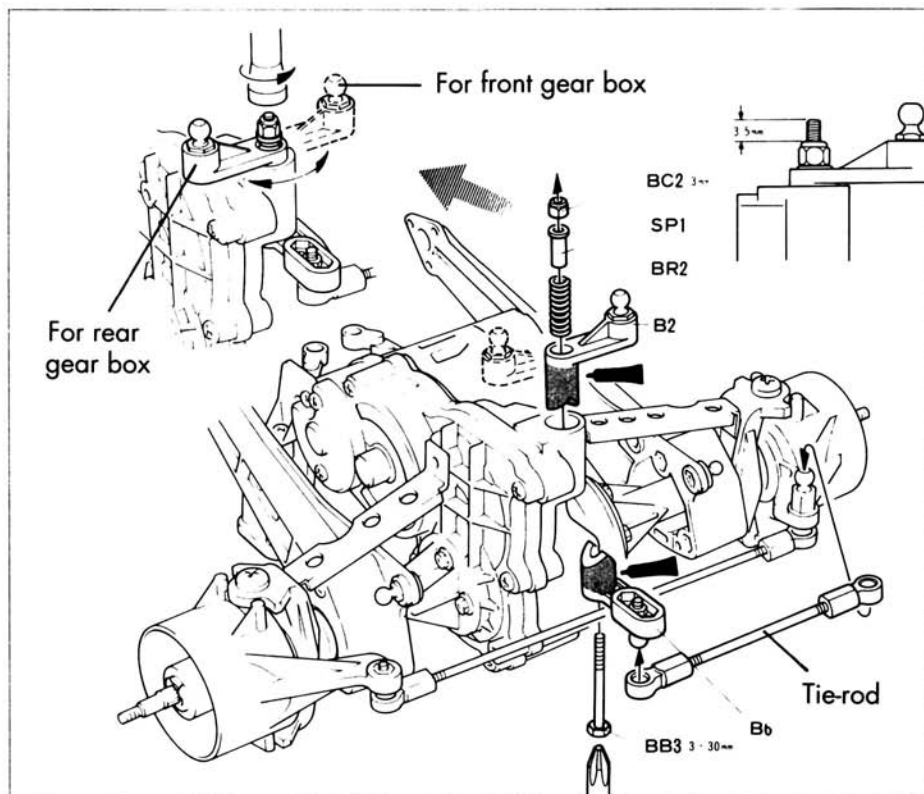
Of course, all this presupposes that you've checked the supplied servo horn to make sure it hasn't been fractured or stripped. They provide two horns: one for Futaba (B3) and the other for Sanwa, Acoms, JR and KO (B4) servos. Generally, I've found that Sanwa/Acoms horns fit Aristo-Craft servos better than the Futaba horns. (Check page 5, panel 4 of the assembly manual.)

If, after all this, you're still having trouble, call MRC in Edison, NJ. Ask for the Customer Service Department, and be prepared to explain your problem in a lot more detail than you did in your letter (preferably with the Clod Buster sitting next to you).

Wings & Things

After reading the March issue of *Car Action*, a friend (who will remain nameless because I want to keep him as a friend!) felt very proud of himself. Having seen my fleet of Tamiya Frogs, he too bought one and proceeded to endow that poor critter with every conceivable piece of speed equipment—most of which was discussed in the March issue. The final touch was a Race Prep Eliminator-15 motor (they rate it at 45,000rpm) and a 16-tooth pinion gear (he used the stock 52-tooth counter gear and a CRP adjust-

(Continued on page 110)



Straight from the Clod Buster manual, Frame 34 details the correct positioning of the front and rear steering arms (inset at upper left) and the correct height of the exposed screw shaft for the tensioner. If you center your servos before installing them and follow these instructions, the Clod Buster steering should be a breeze.

servo and possibly bind the steering rods, making it difficult for the front or rear wheels to turn with the weight of the truck on them. (It's also important to note that, without an expensive high-torque servo,

out through the top of the lock nut. (Read the instructions carefully: The screw should protrude 3.5mm from the top of the nut. The illustration is done to scale.) The four parts (B2, BR2, SP1 and BC2)



THE TEN BEST



Time and again, our readers ask, "Which is the best...?" Last year, we came up with our list of the best cars in 10 categories. This year, Car Action has decided to expand on the 10 Best theme, so our 1989 "Ten Best" issue features not only the 10 best cars, but also bodies, photos, drivers, accessories and pit tips. As you might imagine, the choices weren't always easy. In the bodies and photo categories, many of the decisions boiled down to personal preferences. For the 10 Best Cars and Accessories categories, there was more tangible evidence available, and we based our decisions on this. For the most part, the top 10 drivers were easy to pick—or, at least, six of them were. Choosing tips from Jim Newman's popular "Pit Tips" column was difficult because of the vast number of excellent tips that have appeared exclusively in Car Action over the years. Some of you might disagree with our choices; we know we can't please everyone, but we stand behind our choices! So read on, and find out Radio Control Car Action's Ten Best for '89.



THE TEN BEST

CARS

CAR ACTION'S TOP TEN FOR '89



Ready-to-Run Off-Road **TRAXXAS CAT**

For the second year, the Traxxas Cat (not to be confused with the Schumacher Cat) has earned the title of the best "Ready-to-Run." While a number of manufacturers claim that their cars are "ready-to-run," most require radio installation and some minor assembly. The Cat comes completely assembled with a radio installed—just waiting for a charged battery to bring it to life.

The front suspension is a time-proven trailing-arm configuration that swings in the same direction as oncoming obstacles to soak up the shock (of which it will see a good deal during the driver-training period). To support the Cat's front trailing arms, there's a strong steel rod that spans the width of the chassis, passing through the center of both arms. The rear suspension consists of a solid floating axle that pivots on a centrally located ball just ahead of the differential. While the solid axle hasn't always been the most performance-oriented design, it's rather durable, and with

Getting the best radio-control car for your money is the goal of every R/C consumer, but deciding which is the best can be a highly subjective matter. The first hurdle is deciding what type of car you want; hurdle number two is deciding what car in that particular class would be best for you and your budget.

The editors of Car Action used many criteria to select the following "10 Best." While many purchases are based on a car's performance at a national event, the Car Action yardstick used to size-up these cars includes a number of other factors, one of which is the availability of the car and its spare parts. The hands-down fastest R/C car is no use if you can't get your hands on it. By the same token, even if you could get your hands on a particular car and it broke with no replacement parts in sight, it would simply become a really fast-looking mantle piece.

In more than 50 letters a day, our readers ask for guidance in their quest for the best; so here are Radio Control Car Action's 10 best cars in each of their respective classes.

the centrally located pivot, the shocks really control the side-to-side action. Each corner of the Cat is dampened by an easily adjusted oil-filled coil-over shock (which usually isn't found on a car of this caliber). Even if you aren't happy with the job the original shocks are doing, these could be replaced by the Associated or Kyosho Gold-type shocks. Other features include a three-step forward-and-reverse speed control and ball links on the steering rods, instead of the sloppy Z-bends found on many entry-level cars.

Because the Cat comes pre-built with a radio system installed, it's ideal for those dabbling with the idea of becoming involved with R/C. If the commitment is made, the radio system can be removed and installed in a more advanced radio control kit.

Two Wheel Drive TEAM LOSI JR-X2

After 2½ years of testing and developing, the JR-X2 was released in the fall of '88. This car isn't a combination of features found on other popular off-road cars; rather, it was designed from the ground up to be the best off-road 2WD car out of the box. Under the watchful eye of Gil Losi Jr., the JR-X2 went through numerous prototype stages to reach this final production version. From the look of things, the Losi camp will be enjoying the fruits of its labor.

Prior to the release of the JR-X2, to race at a competitive level in the 2WD stock or modified class you had to spend exorbitant sums on after-market high-performance parts, including graphite chassis, entire gearboxes, suspension arms and more. The list of features and their impact on the performance of the X2 go far beyond the confines of this overview, but even a review of its most prominent features should be enough to convince you that this is probably the 2WD car to beat.



The JR-X2's transmission is composed entirely of 48-pitch gears that have been proven more effective than the standard 32-pitch gears. Unlike all other internal ball differentials, the X2's diff is easily adjusted through the side of the trans housing, instead of through the drive cup (this requires the removal of a dogbone). Connecting this diff to the rear wheels is a set of splined drive shafts that are also unique because the drive shaft itself compensates for the differences in distance between the diff and the wheel during normal suspension operation.

The rear suspension is also a radical departure from the upper and lower A-arm configuration that has been so popular in the past. The JR-X2 features five-link trailing-arm rear suspension that reduces squatting under acceleration and improves handling. And if that's not enough for you, the JR-X2 also comes with a graphite chassis!

As well as its innovative features, the car has a totally convincing performance. This car has already taken a number of top-level races by storm, so don't be surprised if you see it making an impact at *your* track!



2WD Entry Level KYOSHO RAIDER

The Raider is one of the latest low-cost offerings from the Kyosho Corporation, which many of you know as one of the largest manufacturers of quality R/C cars.

Out of the box, the Raider doesn't necessarily outshine all its other entry-level adversaries, but it's more than capable of holding its own when subjected to the less-than-calculated driving style of the novice. To help the Raider stay on the right track, its suspension looks like that of the RC10. The front end features a semi-trailing arm design with a lower A-arm and upper control arm. While the upper control arm is solid and non-adjustable, it permits the camber angle to remain relatively unchanged throughout the suspension travel. The rear suspension consists of lower A-arms and similar upper control arms to keep the wheels in their original upright positions. For dampening, on each of the corners there's a coil-over shock (not oil-dampened) with adjustable spring collars. Driving the rear wheels is a midship-mounted motor through a bevel-gear diff that's reasonably good at transferring the power. When you add all this together, you wind up with a car that's able to put more power to good use rather than wasting it. But, as mentioned before, the Raider doesn't leave its competition in the dust. So "Why," you ask, did you pick the Raider as one of the top ten?

Simple: As most drivers progress to more advanced levels of driving and competition, their entry-level machines are often not up to the task of keeping pace with their improved driving skills. In contrast, the Raider was designed around some of the readily available performance accessories, so it grows with the driver's ability. The Raider's design allows the use of oil-filled coil-over shocks for improved dampening, and adjustable upper links (to tailor its handling to the track surface), and universal swing shafts can be added for more frictionless operation. The Raider can easily be improved as your skill increases.



4WD Entry Level **TAMIYA THUNDERSHOT**

The choice for the 4WD entry-level class wasn't easy, as in the past, 4WD cars haven't been considered entry-level, owing to their complex drive systems. Tamiya's new line of affordable 4-wheel drives was headed up by the Thundershot as a performance update to the Hot Shot and Hot Shot II. The Thundershot's features are very similar to those of the previous Hot Shots, as they have a similar bathtub-type ABS-resin chassis, 4-wheel independent suspension, upper and lower wishbone suspension front and rear, oil-filled shocks and shaft-driven front and rear gear-type differentials.

The criteria for entry-level cars includes ease of construction, durability, low level of maintenance and driveability. In the category of construction, the Thundershot, like most of the cars in the Tamiya lineup, rank as one of the most straightforward and easy-to-build cars on the market. The instructions are an example that many manufacturers should follow. They give clear, step-by-step guidance through the construction process and have detailed diagrams to help builders during the harder-to-understand segments.

The Thundershot also scores high on durability, as this has been the theme of the Tamiya company since its first R/C car rolled off the production line. This durability has been achieved slightly at the expense of performance, but driving from a remote position affords the first-time enthusiast the opportunity to slam the outside wall and suffer no more than a bruised ego. This inherent durability also means there's a minimal amount of maintenance required. And when combined with the "no-adjustment-required" shaft drive and the bathtub chassis, which shield the innards from the ill effects of dirt, it all adds up to more racing and less repairing.

Despite the Thundershot's toughness, which usually spells excess weight and poorer performance, this car still exhibits respectable handling traits. Its 4WD affords drivers a larger margin of error in both throttle and steering

control, while its reasonably low weight permits stronger acceleration.

Although the Thundershot won't get you to the Worlds, it embodies a number of desirable traits for the would-be enthusiast. It's strong, fleet of foot, and best of all, affordable. There are many options for newcomers, but, in our opinion, the Thundershot is the best buy for beginners' 4WD bucks.

4WD Off-Road **KYOSHO TURBO OPTIMA MID SE**

The Turbo Optima Mid SE is the latest in a line of cars developed to be top-notch competitors in the 4WD class. With each stage of development, the Optima picked up a few new trick accessories to shorten lap times, increase run times and reduce maintenance time. The Turbo Optima Mid SE has what are considered to be the most desirable traits of a four-wheeler.

This updated version of the Optima Mid retains many of the features that made the standard Mid so popular, and it also has some new performance accessories. New to the Turbo SE are: Platinum shocks that are stronger than the Gold shocks; a duraluminum chassis; stiffer and lighter carbon-fiber shock towers; and belt-driven front and rear ball differentials that allow you to fine-tune the Optima's handling. Other performance aids include a pair of univer-



sal front swing shafts, a rear anti-sway bar and, for good looks, chrome-plated plastic wheels. The standard three-step speed controller is many times cast aside in favor of an electronic speed control, but this has also been updated to handle more current and remain dirt free. As trivial as they might sound, these assorted items have improved upon the car's already remarkable handling. But a good-handling car isn't necessarily the best. Other factors considered in choosing the Turbo SE include availability of the car and of replacement and hop-up items, and, even though it isn't an entry-level car, construction also plays a role.

Although it might have been a problem getting your

hands on the Mid SE when it was first introduced, because it was being quickly scoffed up, the mad rush is now over, and there should be a good supply in Your Town, USA—and elsewhere for that matter. The parts distribution network is equally effective, and this will keep you car off the bench. Through Kyosho's Option House line, there are a number of factory-made hop-up parts at your disposal. In addition to the factory parts supply, there are a number of other manufacturers' after-market accessories available.

The final consideration for the SE was assembly. Cars of this caliber are usually available on a limited basis, and more emphasis is put on the car than the construction process. While buyers of this type of car usually have a reasonable amount of experience with R/C cars, some of the assembly instructions make even the most experienced modeler rage with frustration. Not so, with the Mid SE. As anyone who has built a Kyosho car can tell you, assembling their cars is a breeze, owing to the simple instructions provided and the quality of the parts. The Mid is no exception. Although more time-consuming, assembly is just as simple as that of any of Kyosho's entry-level cars.

With the Turbo Optima Mid SE, a balance has been reached between elite performance and mass availability and durability. If your niche happens to be with the four wheelers, and you're in the market for a new car, look no further than the Mid SE.



2WD Truck **TAMIYA BLACKFOOT**

For the second year running, the Blackfoot from Tamiya has taken top honors as our choice for the best 2WD truck on the market.

The Blackfoot is the first of a large line of Tamiya trucks. Its backbone is actually the chassis from the popular Frog off-road car, which also gives us the chassis for the Monster Beetle. With its respectable power and good speed, the Blackfoot can tow boats, custom trailers, pulling sleds,

or even cars, and it runs on every type of racing surface, from the back yard to the racetrack.

The Blackfoot has a chassis made entirely of ABS plastic, which is rugged and flexible enough to soak up the hardest hits. To help absorb the rest of the bumps, the Blackfoot has 4-wheel independent suspension that consists of upper and lower arms on the front and trailing arms on the rear. Each corner is supported with a coil-over spring dampener. For the power transfer, the kit includes a 3-speed forward and reverse speed control. But the features mentioned are also found on a number of *other* monster trucks (although they may not be used as well as they are on the Blackfoot). What makes the Blackfoot appealing is that a majority of its parts can be swapped with those designed for the Frog, as well as with parts made for the Blackfoot. These parts ensure that whatever your intentions (sled pulling, car crushing or racing), there will be a parts pipeline to support your efforts as close as your local hobby shop.

As a result of our Monster Truck Shootout, it was very evident that the Blackfoot was a tough competitor with a low overall weight (owing to its car chassis ancestry), the highest top speed and stronger acceleration than any other monster truck.

The truck's inherent weak points include the troublesome dogbones and the weak differential. These areas have been consistent problems in the past, but there's a solution on the horizon, as after-market manufacturers have come to the rescue. A handful of manufacturers now produce parts to improve these weak areas as well as a wide variety of other parts to complement the truck's performance. As a final concern, availability was once again considered but, just as last year, kits for the Blackfoot were spotted on the shelves of just about every hobby shop.

4WD Monster Truck **TAMIYA CLOD BUSTER**

As shown by our Monster Truck Shootout in the May '88 issue of *Car Action*, the Clod Buster would have been the overall victor if it weren't for its higher-than-average price tag.

The Clod Buster is the mightiest of all, with its twin motor power and weight of almost 10 pounds. During the Shootout, the Clod was able to make short work of 41 pounds in completely stock condition, and this beat all the competition by a sizeable margin. The Clod's appearance is just as staggering as its stance: over 13 inches high with 6 1/4-inch-diameter Terra tires. With a truck of this size and power, one would expect a very low speed and the need

CARS



for special batteries to get the monster moving. On the contrary, the Clod uses a standard 7.2V Ni-Cd battery identical to those used in most $1/10$ -scale on- and off-road cars. It doesn't require any special radio either, even though it has 4WS. The steering is arranged in such a way that it can use a single servo from a 2-channel system (although it could use a stronger servo, in most cases the original will suffice) to turn all four wheels. "What about run time?" you ask. Surprisingly enough, the Clod Buster makes good use of the 1200 or 1700mAh batteries with a run time close to that of the 2WD trucks. Speed is one of the categories that the Clod Buster might have faltered in, but when you consider its size and power, its 10+ mph is a reasonably fast pace.

Since our Monster Truck Shootout, a few more monster trucks have been introduced, but only one poses any threat to the Clod for the second year running. The Kyosho Double Dare is the only other twin-motor monster on the market, and according to our early findings in the Clash of the Titans, the Double Dare is a stout competitor. But it's too early to tell if the Clod Buster has finally met its match. For now, the Clod Buster is still the king of the hill.

$1/4$ -Scale RACO GRAND NATIONAL

As it's a fast-growing segment of the R/C industry, we felt that looking into the $1/4$ -scale world and picking a good all-around car for this year's Ten Best was a must.

As organized $1/4$ -scale racing is still young, this was one of the toughest calls to make. Each of the cars available has a number of noteworthy features, but when it comes down to which was the best overall, the RACO Grand National is the car of choice.

The criteria for choosing the $1/4$ scale are similar (with obvious exceptions) to those used when choosing the $1/10$ -

scale cars. Performance isn't the only consideration. Ease of assembly, maintenance, durability and parts availability are all factors that should be considered when trying to make your entry into $1/4$ scale as smooth as possible.

Features of the RACO Grand National include its 48-inch length, its height of 12 inches, 21-inch width and 30-pound weight. The modular design chassis harnesses a Zenoah Max Power 140 engine (22.5cc) that inhales through a diaphragm carb and exhales through a tuned exhaust pipe for more power. Power is transmitted through RACO's unique, all-gear drive system and then sent to the wheels via a heavy-duty dogbone drive assembly. The chassis is covered with a sharp-looking Ford Thunderbird body, or, as options, you can choose a Pontiac, Buick, Olds or Chevy body, all of which are molded from a very durable ABS plastic. Other features include ball bearings, disc brakes, an on-board starter and three, optional, quick-change gear ratios.

One of the most important factors in choosing the RACO car was its ease of assembly. The GN's assembly is even easier than that of the most basic $1/10$ -scale electrics, with a completion time of 3 to 5 hours, not including painting the body. The kit comes roughly 75-percent assembled with the complete engine and drive train installed. All that remains are accessories (e.g., the bumpers), and attaching the wheels and shocks and other small items (if you want to call them small).

PHOTO BY GREG NEWMAN



In terms of durability, the RACO GN also tops the list, with its rugged modular chassis that just says "no" to pain. If the GN is damaged, there's a stock of readily available parts.

While in a number of races we've seen, there has been a reasonably good split of cars making it to the A-Main (with the edge going to the RACO cars), this isn't all that should be considered when choosing a car of this caliber—never mind the expense! Even if there were no appreciable differences between the performances of $1/4$ -scale cars, we would have to go with the RACO car, because of how simple it makes the road to racing and how easy it is to stay involved.



1/10-SCALE ON-ROAD TRC PRO 10

The seemingly simple designs of most on-road cars can deceive newcomers to on-road racing. At a glance, most of the cars just consist of a flat-plate chassis made of fiberglass or a carbon-fiber composite, and very similar-looking front and rear suspension components. A closer look with a trained eye reveals some of the features of any given on-road car that are considered necessary for improving handling or durability.

The configuration of the TRC Pro 10 is such that it's possible to make almost every adjustment needed for tuning to different track conditions quickly and easily. This car is an extraordinary balance between the more basic on-road cars that are very limiting in terms of chassis tuning (which will cost you in lap times), and cars with too much adjustment hardware that requires constant attention to keep up the winning pace. The Pro has a number of different features that make it desirable for both newcomers to on-road racing and seasoned veterans.

Starting with the front end, the Pro 10 has a large axle (visibly larger in diameter than those of other cars using this system) to prevent flexing under heavy loads or damage during a collision. For a little more beef up front, new steering blocks (RC10-type two-piece) are also used to replace the less substantial one-piece blocks previously used. This axle assembly also permits quick adjustment of the caster angle by loosening the mount with one screw and twisting the axle to the desired location. The rear pod features the popular T-plate configuration that's dampened via an oil-filled coil-over shock. Adjustability of the pod assembly includes dampening rate, progressive dampening rate, spring rate, tweak, ride height and, obviously, diff action. To protect the T-plate and avoid cutting a tire or breaking the rear axle, a pair of nerf plates is attached to the chassis just in front of the rear wheels. The chassis is similar to those on many of the other on-road cars available in both fiberglass and graphite versions, and according to TRC, there are plans to introduce three, new, low-cost versions of the Pro 10. This will allow those on tighter budgets to become involved in the exciting world of on-road racing.

Simply put, the Pro 10 has a host of durability features that are desirable for the newcomer and it also gives the performance demanded by experienced racers. Dialing-in is relatively easy: This is a car that you can build, throw on the track and race. It will handle very well without many adjustments, and even better after some tinkering. But we don't have to convince you of this car's ability; just have a look at its record (which includes wins in a number of events during the Car Action Weekend and the ROAR Oval Nationals) and see for yourself!



Best of the Rest ADVANCE ENGINEERING CUSTOM STREET MACHINE

In the "Best of the Rest" category, we chose a car from all the scales and cars that didn't fit into any of the other categories. Which offers more to those not already involved in any of the aforementioned categories? Our answer?: the Advance Engineering Street Machine.

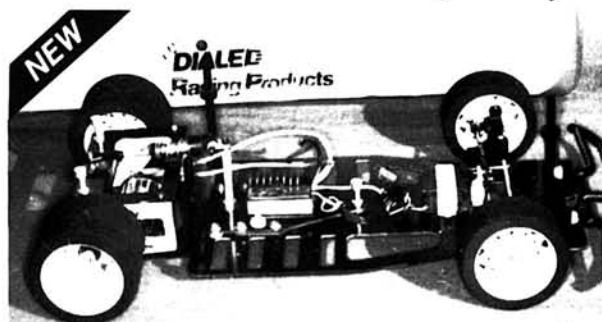
The Advance Engineering Custom Street Machine chassis doesn't have a super-light carbon-fiber composite chassis, a super diff, or a 42-point dampening system; in fact, it doesn't even have a diff. However, it does offer the R/C consumer an opportunity to get involved with radio control for a very reasonable price and without any difficult assembly. While most of us are interested in being involved in some type of racing program, you might want to just tool around with a sharp-looking machine that gives an occasional blast of speed, without wasting money on parts you don't really want or need.

The Street Machine features a sturdy fiberglass chassis, front- and rear-axle assemblies, a battery tray, a drive gear, adjustable motor mounts and instructions. Two versions are available (Basic or Deluxe) depending on how much you want to spend. With the Basic Kit, you get a set of white nylon wheels that can be dyed mounted with foam

(Continued on page 42)

DIALED Racing Products

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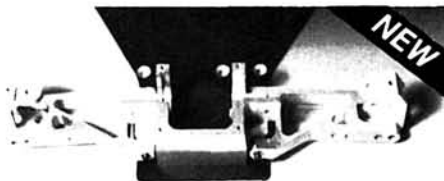
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TEN BEST

tires, and with the Deluxe Kit there's a set of precision machined-aluminum wheels with real rubber-treaded Grand Prix tires. If you want to add more touches to your street machine, there are some optional accessories, which include ball bearings, Vari-Trac ball differential, belt-drive system, speed control, realistic exhaust headers, wheels, tires and more.

One of the best features of the Street Machine is that virtually any 1/10-scale body will fit its chassis. The front axle has several pre-drilled mounting locations so that you can easily change the wheelbase to make it fit the body you want. From rods to racers to pickups; they all fit easily.

The Street Machine is based on a 1/10-scale drag-racing chassis, so even if you intend to cruise 99 percent of the time, during the other 1 percent, you might want to go for broke, and the Custom Street Machine can deliver. ■

Publishing Career Opportunity

Air Age, Inc., publisher of Radio Control Car Action and other hobby-related publications, is looking for creative, self-motivated college graduates who are interested in a magazine career. You will work on a variety of magazines and books, and you must have in-depth knowledge of the R/C hobby. Experience in writing, editing and photography preferred. This is a great career opportunity with a fast-growing company. Send résumé to:

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THE TEN BEST PHOTOS

R/C PHOTOJOURNALISM

WHEN WE DECIDED to publish an R/C car magazine four years ago, one of our first commitments was to provide our readers with a super, high-quality, dynamic medium. Of course, to meet this objective, hot photography was imperative. Resources and budgets were thin back then, and ingenuity was the order of the day. Many of the photos were shot by the "in-house" staff and Publisher Louis DeFrancesco, Jr. He comments, "Most people don't understand how to shoot these elusive R/C cars—even professional photographers. We ended up shooting most of the cars ourselves. I can remember crawling around the beach with our art director in the middle of February with the temperature about 10 degrees, freezing our tails off—my hands frozen to the camera—trying to get the shot we were looking for. We've built up a talented pool of photographers over the past four years, but I still find myself shooting in all types of situations!" To come up with the 10 best photos was a tough one, since there were so many outstanding photos to choose from, but we think these best represent the creativity and ingenuity of Radio Control Car Action and its photographers. We hope you enjoy them.



ESTHETIC VALUE

Photo by Steve Pond

Crawling on the ground like a weasel seems to be a necessary part of getting the right perspective when photographing these R/C cars. Steve was in the thick of it during the Concours competition at the King 8 Supnationals in Las Vegas when this impeccably finished WCM Grand National caught his eye from the pits. Steve comments, "The car wasn't entered in the Concours because it had to be qualified to be eligible, but I couldn't let this one slide without a few frames. It's just too awesome looking." The rest is history!



ASCENDING SCALES

Photo by Louis DeFrancesco, Jr.

Regular readers of Car Action are used to our "theme issues." We've featured everything from Dirt Oval to Monster Trucks, and we even slipped in a Ferrari issue back in April '88. No one can resist those blazin' red rocket ships that bear the black prancing horse symbol. The smaller-scale R/C Ferraris that we reviewed in the issue were shot against Louis DeFrancesco's full-scale '87 Testarossa. "It made a great contrast," Louis said, "those neat, small Testarossas set against the sweeping lines of the full-scale one. Steve Pond and I had a great time on this shoot. No, I didn't give him the keys to mine!"



GROUND POUNDER

Photo by Tamiya Staff

Favorites among R/C modelers are those wild car-crushing monster trucks. One of the first R/C monster trucks was introduced by Tamiya back in 1985, and it was called the Bruiser. It was quite innovative and featured 4WD and a three-speed transmission you could shift via R/C. (We featured it in our premier issue.) Shot at the Tamiya test track in Shizuoka, Japan, this car really captures the spirit of R/C. Definitely a true "ground-pounder"!



PALERMO PYROTECHNICS

Photo by Alan J. Palermo

Fred Murphy, a frequent contributor to Car Action, as well as our advertising director, reviewed the Fine Design Funny Car in the July '88 issue. We wanted to do something really off-the-wall, so Senior Art Director, Alan Palermo, was recruited for the job. We still haven't figured out what explosive device Alan planted in Fred's funny car, but when the fuse was lit, he expected the car to become a glimpse in his memory. We're thankful that no one called the bomb squad, and that a thorough damage check revealed only a singed wheelie bar. Fred is still racing the car, but no longer inviting Mr. Pyrotechnics along.



IS IT LIVE OR IS IT MEMOREX?

Photo by Steve Pond

Last fall, Associate Editor Steve Pond made his yearly pilgrimage to Las Vegas to cover the King 8 1/4-Scale Championships. Commanded by the Ayatollah "to bring back dynamite photos or you'll be sweeping the floors at Caesar's Palace!" he knew there would be no margin for mediocrity. Well, Steve hit the photo jackpot with shots like this one of a Raco prototype, soon-to-be-available Indy car. The shot gives us such a full-scale look that it's virtually impossible to tell it's not the full-scale racer. Only a trained R/Cer's eye could pick out the radio antenna!



LIGHTSPEED

Photo by Rich Uravitch (King Yura)

Car Action's Technical Editor—a person who only comes out at night—was given the task of capturing the Kyosho Cosmo on one of its frequent nocturnal nemesis missions. Blasting cross-country into the black abyss of night, the lights of the Cosmo pierce the unknown; faster and faster, seeking an unseen adversary. What conquests lie down the off-road? Only the Ayatollah knows for sure! For certain, when Cosmo returned to the garage, it had a giant, chewed-up piece of Lexan hanging from its mouth, and the King had an equally giant smile on his face. Night time is the right time!

PHOTOS



LET IT FLY

Photo by Mike Lee

Our resident West Coast Samurai contributor, Mike Lee, was given the task of modifying the MRC/Tamiya Boomerang for Car Action's "Budget Series." Mike is a seasoned veteran of R/C and frequently flies R/C pattern planes in competition. Who could be better suited than Samurai Lee to deliver "airborne" shots of the Boomerang? As evidenced by this dramatic flight shot, Mike completed his Kamikaze mission with flying colors. Mike has been a regular contributor to Air Age Publications for over 10 years—keep up the good work, Mike!



UNSCHEDULED FLIGHT

Apparently, Dave had been experimenting with much larger rocket engines! The car was last sighted over Duluth, Minnesota!

...5, 4, 3, 2, 1...IGNITION!

Photos by Dave "Rocket Man" McNattin

Dave McNattin decided he wanted his Kyosho Plazma to go faster. Much faster! Rocket power was the obvious choice. He retrofitted his brainchild with a 7-inch Estes rocket and crossed his fingers. The rest is history. This ominous sunset shot looks like a scene at the Bonneville Salt Flats—definitely one of our favorites. I wonder what he's working on now!



MAELSTROM

Photo by Louis DeFrancesco, Jr.

The December '87 issue of Radio Control Car Action featured a track report on Hobby Lobby's 4WD nitro-powered Toronado. This off-roader blew everyone's mind when we zapped it with the radar gun, and saw that it consistently reached speeds near 45mph on pavement! The car was shot in August with Chris Chianelli on the transmitter (watch out!). The parking lot at Air Age Publishing, at one time flooded, was then dry mud, baked by the summer sun—a great place to get that "Baja" dust-bowl shot. Louis comments, "The car was so fast and Chianelli so wild at the controls, that some of the photo frames didn't even have the car in them!—Not to mention how dangerous it is shooting something going so fast while you're lying on your stomach!" It's a tough job, but somebody has to do it! Needless to say, we've retired Editor Chianelli from transmitter duty on the shoots!



RISKY BUSINESS

Photo by Louis DeFrancesco, Jr.

Project Optima, built by Fred Murphy, brought us to the local BMX bike track so we could get some killer "flight" shots. We decided on a steep camel-back jump for the shoot, and Louis DeFrancesco positioned himself, lying down, 8 feet in front of it. The problem was that he could only see the car when it was airborne, because of the steepness of the camel-back. Fred sent the tricked-out Optima over the jump at full throttle and nailed Louis in the face—the third time he's had an altercation with one of these cars! It was well worth incurring the battle scar, since the airborne car was caught in a perfectly level attitude. Camel-back jumps have since been outlawed in BMX racing (they took a heavy toll on riders and photographers!), but we're still getting down in the dirt to get that "shot." Hey, maybe it's time for Louis to invest in a hockey mask!

THE TEN BEST BODIES

CONCOURS CANDIDATES

TRUE, BEAUTY is only skin deep; but it's great that the body makers are forming those sheets of polycarbonate into so many interesting, beautiful shapes to keep R/C car racing new and exciting. Whether you have an off-roader or the latest superspeedway scorching chassis, your car can be transformed into anything from a pickup truck to a sleek, futuristic-looking GTP racer. By virtue of their originality and workmanship, here's Car Action's Ten Best Bodies for '89.

PARMA



'57 CHEVY

Here's a classic that makes a great street-rod: the Parma 1/10-scale 1957 Chevy. From the front bumper bullets to the tail fins, this car is easily recognizable. Today, racers are using the '57 for Prostock drag racing, but it was originally a very popular oval-track stock car, too. R/C enthusiasts can use the good lookin' Parma Chevy in many ways, including as Von Erich's Rug Rat Sled Puller.

PARMA



OLDS FIRENZA FUNNY CAR

As well as being one of the first available 1/10-scale funny cars, this scale-like Parma Firenza is well-detailed. Whether you want to make this body look like Larry Minor's famous Miller High Life Oldsmobile, or make your own wild-looking creation, the Parma Firenza is a great shape on which to lay your paint.

BOLINK



'88 PONTIAC

The first body to break the 50mph "speed barrier" at Lake Whippoorwill International Speedway was the '88 Pontiac manufactured by BoLINK and driven by Joel Johnson. This body continues to be extremely popular, especially on the high-banked oval circuit. While a few other bodies have attained these speeds since then, BoLINK was the *first*, and even offers a pre-painted Petty version of the Pontiac for those who want to duplicate the King's car.

MCALLISTER



TOYOTA PICKUP

McAllister's 1/10-scale Toyota pickup truck was one of the first bodies to show up on the heavy-metal off-road racing scene. This Toyota looks right at home as a monster truck, or you could create a tricked-out 1/10-scale Stadium Racer that would have made Mickey Thompson proud.

PARMA



COBRA

Parma has produced one of the all-time favorite two-seater sports cars from the '60s—the Shelby Cobra. Shelby advertised that his high-powered car could go from 0 to 100mph and back to 0 in 13 seconds flat, and Parma has done a nice job recreating the curvaceous Cobra and bringing much of the excitement of the full-scale machine to 1/10 scale. By removing the roof, side and rear windows, the Cobra could also be used as a convertible.

MRP



'89 THUNDERBIRD

After 18 seasons of racing *only* GM products, NASCAR owner Junior Johnson has switched to Ford for '89. Rumor has it that Junior likes the '89 Thunderbird's slippery looks and impressive wind-tunnel figures. MRP has done a good job of converting the Thunderbird's aerodynamic shape to 1/10 scale, and at the time of publication, it was the third-fastest qualifier at Daytona. We think the MRP '89 Thunderbird shows equal promise on the 1/10-scale super-speedway circuit.

PARMA



'33 FORD COUPE

The '33 Ford Coupe, which is easily recognizable from "ZZ-Top" videos, is well-done in 1/10-scale by Parma. The '32 and '33 Ford Coupes have long been representative of the hot-rod phenomenon that's so apparent in the U.S. Parma can supply this body pre-painted, leaving only the trim work to be done, and the car can even be cut down for classic, modified, short-track oval racing.

MRP



CORVETTE-LOLA GTP

The only current 1/10-scale reproduction of the Corvette-Lola is made by MRP. This sleek, low-slung beauty is well-detailed and does justice to its full-scale counterpart. Although the Corvette-Lola hasn't done too well on the full-scale IMSA GTP circuit, its fans remain very enthusiastic—but probably because of their Chevy loyalty. Check this one out for 1/10-scale road racing.

MCALLISTER

WHIPPOO



PENSKE PC-17

McAllister's 1/10-scale replica of the famous Penske Indy car is sure to delight open-wheel fans. The PC-17 was dominant in 1988—winning both the Indy 500 and the CART Championship. The Penske was driven by Rick Mears, Danny Sullivan and Al Unser Sr., and was competitive on both ovals and roadcourses. This body should fit all the popular 1/10-scale on-road chassis.

DAHMS



FIREBIRD GTP

Dahm's well-detailed, aerodynamic GTP body can be finished as either a 4-cylinder Firebird Camel Light car, or as a big-bore 8-cylinder Firebird IMSA GTP prototype. The body comes with a very functional wing, templates, finishing instructions and a sponsor sheet. The Firebird will fit all 1/10-scale on-road chassis.

THE TEN BEST DRIVERS

FROM THE FAR EAST TO THE WEST, THESE TRIGGER FINGERS ARE THE BEST!

Car Action's Ten Best Drivers are individuals who have driven consistently well under the strain of heated competition, and have repeatedly extended a helping hand to others in the name of good sportsmanship. We salute them and thank them for setting an example and for offering inspiration. Please note that the drivers are listed in alphabetical order, not by standing; they all get the Car Action blue ribbon.



BUD BARTOS

From Amherst, OH, 35-year-old Bud Bartos originally became involved in R/C racing in the same way as many other racers and manufacturers—by way of slot-car racing. Ten years ago,

as a successful racer and chassis builder, he had been on the slot-racing scene for a number of years when he won a store credit that he didn't know what to do with. A 1/12-scale Associated 12E in the showcase caught his eye—and the rest is history! Because of his expertise with slot cars, he was always able to experiment and fabricate his own components. Today, he owns and operates Bud's Racing Products.

Bud won the '84 1/12-scale IFMAR Stock World Championship, and has twice won the Novak Enduros at Lake Whippoorwill. His favorite type of racing is 1/12- and 1/10-scale superspeedway oval racing. He hopes to continue in R/C racing and to make it an enjoyable hobby/sport for others. Firmly believing that *fun* is the key word, he's particularly in favor of races like the Trinity Sportsman Cup Race, which is for beginners and intermediate drivers. After 10 successful years in R/C, 25 years racing slot cars, and 3 years in full-scale race cars, Bud has surely earned his place among our top 10 drivers!

RALPH BURCH

Ralph Burch started his racing career in '79 on a small, indoor, electric track in Eueless, TX, where he quickly established himself as a strong Southwest competitor and was offered a sponsorship by Jomaç (a partnership that lasted through '83). During that



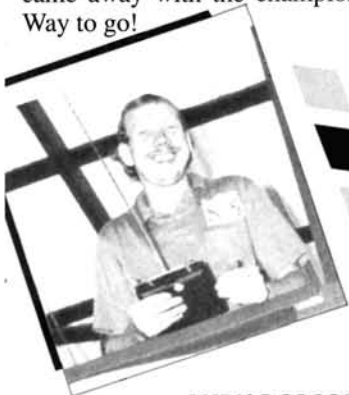
period, Burch won three National Championships, including TQ and wins at the the Nats in Boston in '81, and in Modified and Production Classes at Indy in '82.

In '81, Burch also started his gas-car racing career, qualifying 2nd at the World Championships at Indy—only his fifth gas-car race! From there, he has gone on to become one of the sports' finest.

Ralph has qualified in *every* 1/8-scale World Championship since '81. He has won 13 ROAR Championships, including four in 1/12 scale, eight in 1/8 scale and one in 1/4 scale. He has won the Winternationals four times and the McCoy gas-car championship three times (including two consecutive wins).

In the summer of '88, Ralph flew to California where he won the McCoy, then flew back to Florida to stun the world with an unprecedented 9-lap, runaway win at Lake Whippoorwill International Speedway, so making an electric-car comeback.

What are his most significant career moments? "Winning the McCoy back-to-back" he said, in a recent interview, "and winning at Lake Whippoorwill. We went down there racing the best teams in the world with the new Hyper 10, were seen as underdogs, and came away with the championship." Way to go!



ANDY DOBSON

Twenty-six-year-old Andy Dobson was born and raised in Maidenhead, England. Though still young, he has been racing for 11 years, and he actually began by racing 1/8-scale gas cars, moving later to 1/12-scale competition.

Originally sponsored by Schumacher Racing Products of England, he soon went to work with them full-time, helping to develop the 4WD Cat. In '87, he moved to the US to work as an R&D technician for Parma International, of Cleveland, OH. Since going there, he has assisted in the development of the Pro Panther line of 1/10- and 1/12-scale on-road race cars.

He also races for Parma, and his best results are 2nd and 4th in two 1/12-scale World Championships. He recently began racing 1/10-scale on-road cars, too, but 1/12-scale is still his first love.

He says he's proud to be one of *R/C Car Action's* top 10 racers of '89, and he says he appreciates our "fine coverage and support of this exciting sport over the years." We appreciate *his* performance!



CHRIS DOSECK

Twenty-one-year-old Chris was born in Sydney, OH, and had his first experience in R/C racing with a 4-cell 1/12-scale car just over four years ago. Shortly after that, Chris had his first major victory at the Region 3 1/12-Scale Championships, and in '87, he began to dominate off-road tracks throughout the Midwest with his 4WD Schumacher car. His efforts resulted in victories in both the Stock and Modified Events at the '87 Region 3 ROAR Off-Road Championships. In his best year yet, Chris started his '88 campaign by winning the prestigious 1/12-Scale Winter Championships, the ROAR Dirt Oval Nationals in 4WD Stock, 3rd place at the ROAR 1/12-Scale Nationals, and 9th at the 1/12 IFMAR World Championships in Holland. For '89, the latest trick from Team Trinity is a back-to-back victory in the '89 Winter Championships' 1/12-scale event in Grand Rapids, MI.

MASAMI HIROSAKA

Masami comes from Tokyo, Japan, and he started racing R/C cars only about 2 1/2 years ago. At the last IFMAR World Championships in England, Masami's father, who is his mechanic, assembled a Schumacher 4WD off-road car *at the track*, and Masami promptly *won* the IFMAR Championship with it!

Using a stick radio, after the race, he gave the crowd a driving demonstration. He turned the transmitter upside-down and promptly drove the car around the track—almost as fast as



before. You have to realize that all the controls were backwards then: Left was right, right was left and throttle was steering, etc. Then his father held the transmitter and Masami drove the car around the track with his *toes*! This is the competition, guys!

Masami next worked for Yokomo and, with his Reedy-powered RC10, 12L and Yokomo cars, he won the IFMAR 1/12-scale World Championships in Holland, the Japanese Nationals and the Australian Nationals. Keep your eyes on this one!



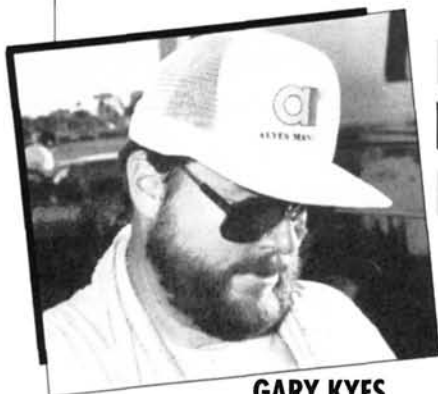
JOEL "MAGIC" JOHNSON

A student at San Jose State College majoring in business and marketing, 21-year-old Joel started racing at the age of eight with a .049 gas-powered Cox Jerobee 1/12-scale Dodge Challenger. Joel, a member of the Kyosho racing team, is the current

TEN BEST DRIVERS

defending 1/10-scale IFMAR 2WD World Champion and will have to face those who wish to claim his title this August in Sydney, Australia.

Considering the fact that he's a 12-times winner of the 1/12-scale National Championships, it should come as no surprise that Joel's favorite type of racing is 1/12-scale electric racing on carpet. Joel says, "My best win was my World Championship victory in England, and my biggest defeat was my loss of the 1/12-scale World Championships in Las Vegas by 2 seconds. I'd still like to win the 1/12 World Championships before I retire." That's the spirit that makes Joel a winner!



GARY KYES

After 17 years in racing, what's Gary's most memorable race? The '79 Monoco World Cup (World Champs before IFMAR) The reason? Gary was impressed with the "unbelievable" spectator appreciation and the very professional way in which the event was run. As it should be, the event was treated, "as a sport and not a hobby." After his 2nd-place finish, he was thrown into the famous Olympic swimming pool!

Originally from Ontario, CA, he started with a used RC-1 (1/8 scale), an Orbit Cobra radio, and a Veco 19 motor, and during his career, he has won over 25 ROAR National Championships including, the first ever 1/12-scale Electric National Championship, 1/12-scale Gas (now a memory), 1/8-scale Gas (2WD, 4WD and Pre-suspension),

Road, Oval and Drag Classes and 1/4-scale Oval. He has won every major 1/8-scale race at least once; the McCoy three times; the Winter Champs twice; as well as many regional champs.

Gary was the first 1/10-Scale Off-Road World Champ (1979), and has been the J.G. Oval Champ, an IFMAR World Champ finalist in 2WD and 4WD (1984) and 1/8-Scale World Champ finalist several times.

As well as all this, Gary worked for five years at Model Racing Products, where he aided in R&D as well as merchandising, and he also successfully raced the first Sanyo batteries. Now he's VP of Team Losi Performance, and is serving his second consecutive term as VP of ROAR. See why he's on our list?!



CLIFF LETT

Teamed with Jay and Jim Halsey, Cliff started racing about three years ago. Last summer, after leaving Yamaha Motorcycles' racing division, he joined Associated's R&D team and, since then, his racing accomplishments have been incredible. Last summer, competing against a field of 620 entrants, he took 1st in the biggest R/C car race ever—the ROAR Off-Road Nationals. But that was only one National Championship.

A look at his list of accomplishments shows that he's won even more—a lot more—ROAR National Championships than any other driver ever has in a single year. His driving ability is also shown by his successes

in 1/10-scale on-road and 1/8-scale gas races.

Already a great driver, Cliff continues to hone his skills, and he shows exceptional abilities as a mechanic. His cars are about as perfectly prepared as is humanly possible, and that has been a key factor in his national success.



GIL LOSI, JR.

Another top driver from Ontario, CA! Must be all that orange juice! At 26, Gil has been racing 9 years, having started with his father (Gil Sr.), his brother Alan and a Tamiya Rough Rider.

His impressive list of accomplishments includes winning the 1/10-Scale Off-Road World Championship four times, the '86 1/8-scale McCoy, the '88 Japan National Championship, the 1/10-scale Winter Champs (twice), the 1/10-scale JG Oval (twice), and he's been a finalist in the 1/8-Scale World Champs several times.

Gil says that his most memorable race is the 1/8-Scale World Champs held in Carnoux, France, where he was impressed with the beautiful facility, the professional atmosphere and the enthusiasm of the crowd. Gil took 2nd in the SCORE 1/10-Scale World Champs, beating all the trick cars in both Stock and Modified with his Cox Scorpion.

We don't know how, but he has even found time to design the RC12L, to help develop the RC10, to design/develop the JR-X2 and to develop the floating, ball-type T-bar system now used by most 1/12- and 1/10-scale on-

road cars.

He's now VP of R&D at Team Losi Performance, and is a top 1/8-, 1/12- and 1/10-scale racer, builder, and trainer. Hats off to you, Gil!



TONY NEISINGER

Tony started racing in Ventura, CA, with the local club. As he became more proficient, he started to travel to the Los Angeles area to run against the fast guys, and it wasn't too long before he was *beating* them.

After joining the Associated/Reedy team, he won the IFMAR World Championships in Denmark with a Reedy-powered Associated RC12i car and, at the following IFMAR World Championships in Las Vegas, NV, he took 1st again. (This time, he used the new Associated RC12L car, again with Reedy power.) This gave him back-to-back IFMAR World Championships, and he's the *only* driver who has accomplished this. No other driver has ever won more than two IFMAR World Championships. At the next IFMAR World Championships in Holland, he came within a few seconds of winning again, and earned a well-deserved 2nd place.

Tony's driving ability was probably best shown at the first IFMAR Off-Road World Championships in Del Mar, CA. After only a few practice races beforehand, he finished 3rd with his Associated RC10 car and Reedy power. Driving an Associated RC500 4WD car with Paris horsepower, he also finished 3rd in the last IFMAR 1/8-scale gas World Championships. His consistently high finishing places at IFMAR World Championship events have given him the best overall record of *any driver in the world!* WOW!

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1371	1/10 ELIM 10 BASIC FIBERGLASS	99.99
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010	RC 10L GRAPHITE	149.99
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YZ10	YOKOMO KIT	239.99

TRC

1000	PRO 10 GRAPHITE	189.99
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5000	PREDATOR GRAPHITE	154.99
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	1/10 OUTLAW STOCK CAR	144.99
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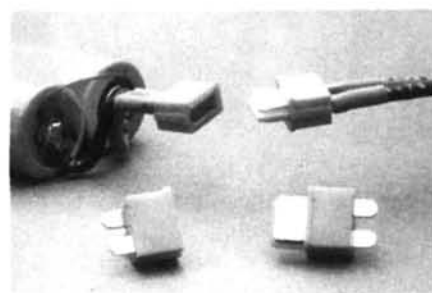
TEN BEST PREFERRED PARTS ACCESSORIES

HOW MANY ACCESSORIES do you think there are on the market today? One thousand, five thousand? I don't know about you, but we sure didn't want to take the time to count them. Keeping this in mind, you can imagine how difficult it was to come up with the Ten Best Accessories. The considerations had to include market acceptance and usefulness, uniqueness and, of course, technical merit. We hope that most of our chosen accessories meet these criteria, but after a truly democratic form of editorial voting, here are the Radio Control Car Action Ten Best Accessories for 1989.



HYPERDRIVE SYSTEM

This revolutionary new drive system is designed to run with less friction than the standard pinion/spur-gear drive. It handles more power and allows longer run times and easier adjustments. The Hyperdrive system was originally designed for 1/12-scale cars, but it's quickly making its presence known in 1/10-scale on-road and super-speedway racing and giving impressive performances off-road.



RACE PREP GOLD CONNECTORS

These connectors feature a totally new design for superior connections and super low-voltage drop. With over 10 times the contact surface area of most conventional connectors, the Race Prep connectors are as close to "hard wiring" as you can get. These connectors are efficient and compact, and they allow you to accommodate 14-gauge wire.



KYOSHO GOLD SHOCKS

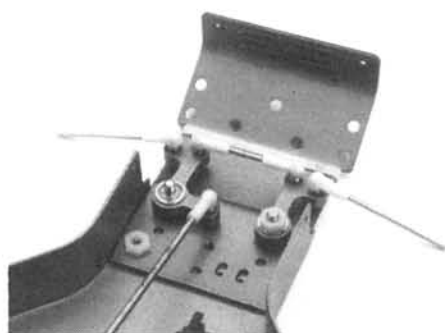
These adjustable pressure shocks are available in both long and short versions, and they'll fit most electric buggies. They're completely adjustable, with coil-over spring collars, and, in seconds, they allow you to prepare your car for any track condition. These famous shocks provide some of the smoothest dampening available.



CHEETAH QC/DC BATTERY SYSTEM

One of the keys to successful long races in 1/10-scale on-road racing is a reliable quick-change battery system. Cheetah Racing has introduced a stick-style system with nylon hooks that enable you to remove a battery pack with the push of one spring-loaded button. With these quick-change systems, which are adaptable to many chassis, endurance-type events will become more feasible.

DRIES



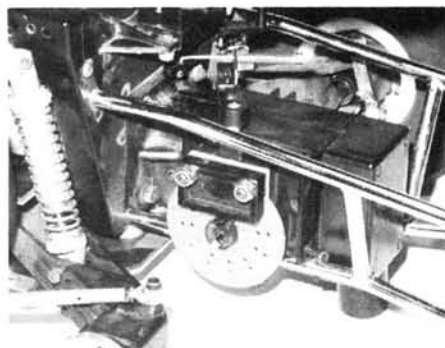
RPS BELL-CRANK SYSTEM

The standard RC10 steering assembly is mounted via a steering-post screw that's subjected to much wear. This wear will weaken the stock unit and cause steering wobble, and this makes driving very difficult. RPS has addressed this problem with the Bell-Crank Steering assembly that's made from machined aluminum and contains ball bearings to provide sure, wobble-free steering without excess wear and frequent replacement.



TECNACRAFT WHEELS

Available in at least five styles, the Tecnacraft modular aluminum wheels have shown up in the concours winners' circle time and time again. They're available in a number of anodized colors as well as in a Super-Light model for weight-conscious racers. They're the class in high-quality aluminum wheels, right down to their optional titanium knock-off nuts.



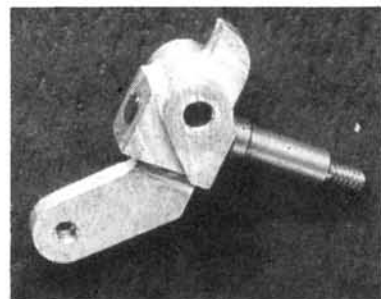
HOT TRICK RACO BRAKE KIT

When it comes to stopping a 30-pound race car, the 1/4-scale crowd has had some problems. They either have too much or not enough braking power, so Hot Trick Racing has come up with a dual-disc assembly that not only helps stop your 1/4-scale car when you want, but also does it *without* overheating the discs and causing dramatic brake fading. This system is fully adjustable to allow for quick stopping power, or you can apply the brake gradually to only lock up at full servo movement. This is a sure show-stopper for the big boys!



THORP "DIRT BURNER" DIFFERENTIAL

This is the first, and only, replacement ball differential for Tamiya's Frog and Blackfoot. This accessory addresses an inherent weakness in both vehicles. It not only makes for fully adjustable differential action, but also allows for the addition of heavy-duty half-shafts and dogbones that are subjected to a great deal of stress.



W.S.S. RC10 STEERING BLOCK

This is a virtually unbreakable steering block for the Associated RC10. The block is a one-piece assembly made of aircraft aluminum to ensure durability, and the stainless-steel axle is threaded and epoxied into the steering block. (This eliminates any chance of an E-clip fastener ruining your racing performance.)

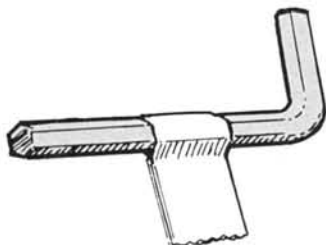


NOVAK 1X SPEED CONTROL

This speed control is designed to give you maximum acceleration and that all-important running time. With external adjustments for neutral and high speed, the 1X allows you to fine-tune for any track condition and will handle the hottest of motors. Whether you're running 4 cells or 10 cells, the maximum continuous-current rating of 360 amps and heavy 14-gauge power wires will take the load. ■

THE TEN BEST PIT TIPS

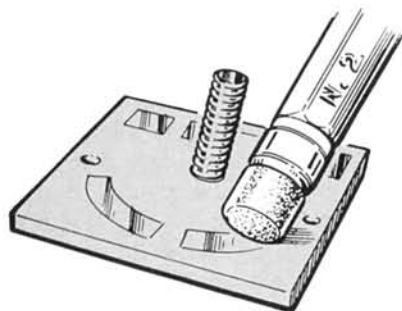
Since *Car Action* first hit the newsstands in the winter of '86, "Pit Tips" has been a very popular column. Jim Newman showcases what we feel are the most helpful modeling tips that are submitted by our readers to be shared with the rest of the modeling world. These suggestions address virtually every facet of R/C cars, from their initial construction right down to running, maintenance and repair. As a result, thousands of modelers have discovered how to make their experience with radio control as smooth as possible. Presented here are our choices of the Ten Best Pit Tips from the past 3 1/2 years.



TAGGING ALLEN WRENCHES

In the heat of fast pit work, dropped Allen wrenches can be difficult to spot on the ground. Wrap a brightly colored adhesive-tape "flag" around the shaft of the key as shown. You could also paint the keys.

Brian Kirby, Fayetteville, PA



ERASE DIRT

To clean the track of your speed controller, simply use a pencil eraser, which will make it bright and shiny.

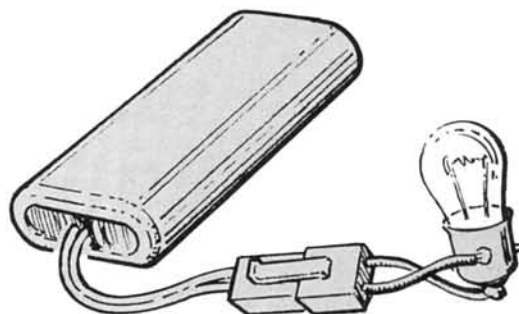
Eric Baier, Oshkosh, WI



RENEW THREADS

Have you stripped out the thread in your plastic car chassis? Using a larger screw is likely to crack the molding, so this racer recommends his method. Inject a few drops of CA into the hole, then wiggle a toothpick in the hole to coat the walls. When the CA has cured—and not before—reinsert the screw. You'll find that it's tight once again and can be securely torqued.

Howard Beringer, Mystic, CT



NI-CD DISCHARGER

Solder a 12V auto bulb to half a connector. When the bulb goes out, the Ni-Cd is "flat" and ready for its fast change. You don't have to worry about putting your hand on top of a hot discharge resistor that you didn't see, and when you're accustomed to using the light bulb, you can estimate how much run time was left in the battery by timing how long it takes the bulb to die.

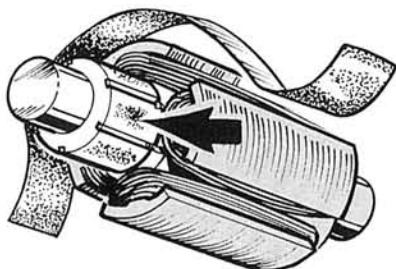
Rick Poon, Huntington Beach, CA



PARTS CADDY

Here's a busy lad who builds cars for others, and to keep all the parts at hand and in sequence, he empties the parts bags into egg cartons. He then tapes the labels from the bags onto the lid in logical order, so everything is handy and well-organized.

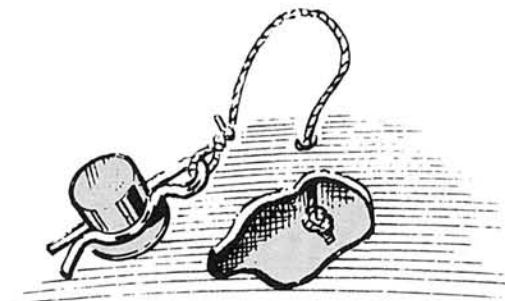
John E. Hsu, Greeley, CO



DIRTY COMMUTATOR

If your car needs a little nudge to get it to run, you might have a dirty or burnt commutator. Our correspondent suggests removing the commutator and polishing it with fine steel wool. I was taught to pass a strip of very fine (No. 600) emery paper around the commutator after lifting the brushes. After allowing the brushes to keep the paper sprung against the copper commutator, spin the armature back and forth to polish the copper commutator segment. Doing it this way ensures that you don't alter the shape of the commutator or leave bits of steel embedded in the insulation, which could cause problems later.

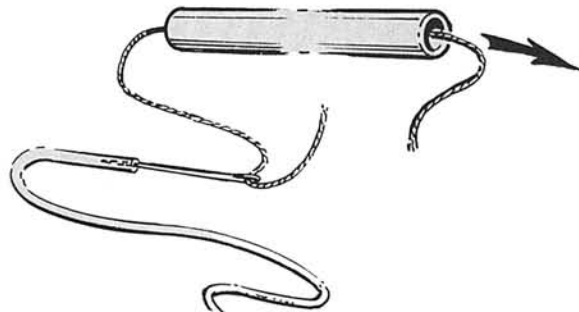
Robert G. Roy, Saint John, N.B., Canada



CLIP KEEPER

So many drivers seem to be losing their bodywork clips, yet the solution is so simple! Tie a fine nylon or Dacron thread to each clip, drill a very small hole in the body, then knot the thread inside the body near the clip.

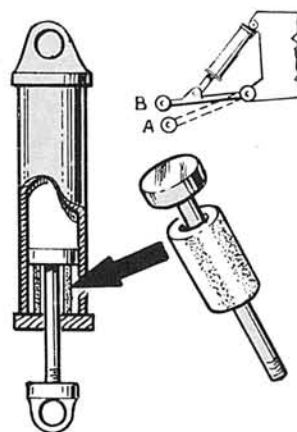
Benjamin Notaro Jr., Vineland, NJ



ANTENNA THREADING

Instead of trying to push the antenna wire up through the antenna mast, drop a threaded needle down through the tubular mast. Then stick the needle through the end of the antenna wire and gently pull the wire back up through the mast by means of the thread.

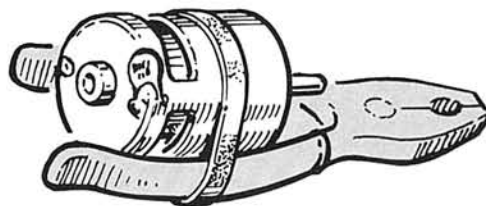
Joe Archambault Jr., Edwardsburg, MI



ALTER RIDE HEIGHT

Placing a short length of surgical rubber fuel tubing on the piston rod of your car's shocks serves two purposes: It acts as a rebound spring at the bottom of the unit's travel, and it alters the ride height, hence roll center, of the vehicle. The small sketch shows how A is the position of the A-frame or "wishbone" with the unmodified shock, while B is the position in the modified state.

Tony Vazquez, Kensington, CA



STABILIZING MOTOR

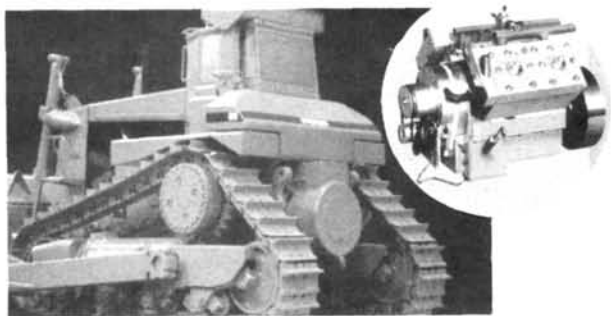
Nesting your motors between the plastic grips of pliers is a simple way of stabilizing them while you work on them.

Zac Wheatcroft, Claremont, CA

INSIDE SCOOP

by CHRIS CHIANELLI

The R/C CAR industry is rapidly advancing, with new products being offered at a head-spinning rate. So, I'll make manufacturers nervous, but feed you R/C squirrels who are hungry for info, by bringing you a special report on security leaks and "late-in" items. Here goes!



FLASH!!

One-ninth-scale bulldozer to be produced! Last month, I stuck my foot in my mouth when I wrote about R/C heavy equipment called Super Scoop. I had told you that the model of the awesome R/C front loader would not be produced and was a one-of-a-kind scratch-built model. Well, shortly after the April *Car Action* hit the stands, I uncovered some information that has changed everything. International Machine Corporation of Mt. Juliet, TN, has just announced the first release in their new product line: a 1/9-scale Caterpillar D11N track-type tractor

with dozer blade.

To give you some idea of just how serious this venture is, IMC has recently signed a long-term licensing agreement with Caterpillar to manufacture this 4-cylinder, water-cooled, 170-pound, 2-foot-high exact scale replica of the Caterpillar D11N. To those of you who wrote me nasty letters because I was unable to supply you with info on where to get your own front loader, I hope this news will get me off the hook. Maybe the next IMC undertaking will be a front-loader stablemate for the D11N. Stay tuned.



WILL IT HIT USA SHORES?

Here's Kyosho's Optima Mid Custom which was, then wasn't, and then was, maybe, going to be imported. One difference is the wider chassis that can take saddle packs or flat packs. The main point of interest is the wheelbase; it's longer than that of the current Mid series—an off-roader that some felt was a bit too short. I can't even tell you for sure if this racer is in full production and, if so, whether or not it will be imported. I hope it will be. Would you like to have it here in the States? We'd like to know.



1/4-SCALE CORRECTION

On page 29 of our March issue of *Car Action*, we incorrectly identified one of the 1/4-scale Indy cars pictured as an Auto Engineering product. The car is actually being manufactured by Race-tech, Inc., 103 Loudon St. S.W., Leesburg, VA 22075.

OPTIMA 14X

An Optima what! Sorry, I know "nossing." (Wise-crack letters pertaining to the aforementioned are most welcome.) Anyway, it looks like a 1/14-scale Optima with its own, would you believe, 1/14-scale pistol-grip radio.



M.I.P. MADE BETTER

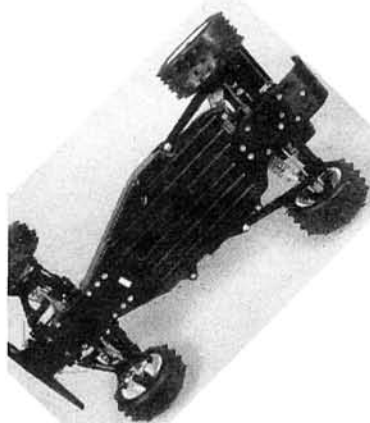
Rumor has it that M.I.P. is secretly working on a new, improved gearbox and differential for the RC10. Could this be true? Maybe the JR-X2 will be next. Fascinating.

MRC 4WD BRAT

Just in!! There are eyewitness accounts of a prototype 4WD Subaru being put through the paces at the Tamiya test track.

Keeping the industry BUGGED, I'll see you next time—or sooner, if I catch you in my spyglass!

CC



A CLOSER LOOK

Last month, we talked about MRC/Tamiya's new Vanquish. However, our spy in Japan, besides using a micro-camera, got caught in the act of photographing what was top secret at the time, and she had to make a hasty exit. Hence, the stinker of a photo last month; but here are some better ones! The resemblance to the Avante is even more striking in these pictures. Note that the plastic suspension components and the shocks are the familiar yellow plastic types.

ATTENTION TRUCK PULLERS

Reliable sources have informed me that a well-known manufacturer is working on a heavy-duty gear reduction unit for a number of applications. This will surely be of interest to truck-pulling disciples in search of that "stump-pulling ratio." Sounds like a monster of an idea!

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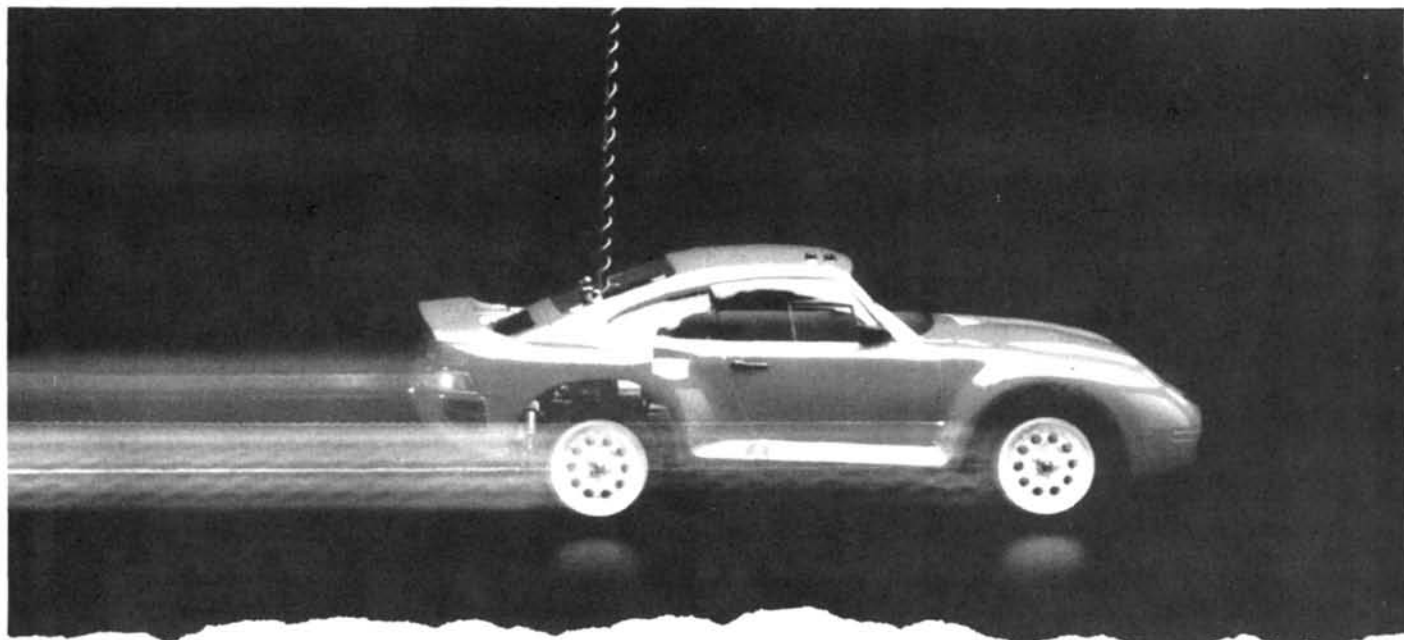
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Understanding Ni-Cds



OPTIMIZING CELL PERFORMANCE

by C.L. SCHOLEFIELD

YOU'LL SEE MANY advertisements for matched Ni-Cd packs for R/C car racing, each claiming some new, revolutionary feature that gives you the winning edge. Articles addressing the various techniques have appeared in hobby publications, and an increasing number of products are being introduced to enhance the performance of Ni-Cd cells: sophisticated charging schemes, "conditioning" devices and performance "analyzers" that pulse, reflex charge, deep discharge, burp, "dememorize", initialize, and stimulate your racing battery to achieve new heights of performance—all compete for your hobby dollars. Confused, facing bankruptcy, or just trying to remain competitive? I think I can help.

Let's look at battery performance from a cell manufacturer's point of view. The choice of which manufacturer's cells to use is rather limited: Two Japanese, one French and one U.S. manufacturer serve the R/C car market. While this market has reached a sufficient size and has significant growth potential to interest all the Ni-Cd producers, the bulk of their business is in serving the manufacturers of indus-

trial and consumer electric hand-tools, so cell development is driven by the increased performance requirements of these markets.

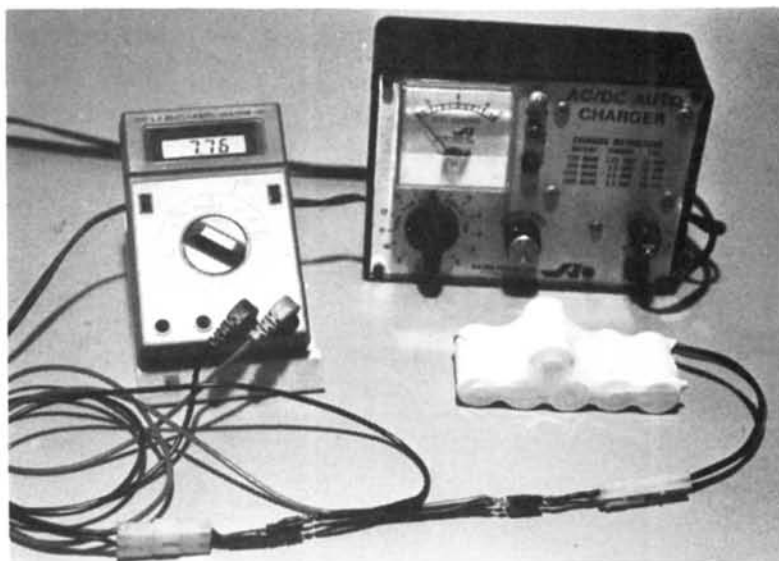
Fortunately, these needs coincide with those of the R/C car enthusiasts: low internal cell resistance (higher voltage delivery at high rates of discharge) and higher capacity (longer run time). It isn't uncommon for cell manufacturers to include special testing for their customers, and to screen production to ensure that specific performance attributes are met with each production lot. Years have been spent refining these processes. The high-rate screening and capacity matching done for power tools is very similar to what should be done (and, in some cases, *is* actually done to a finer degree by hobby battery assemblers) for the premium R/C car battery.

On the subject of matching, let's consider the manufacturing process. Just like any other manufactured product, Ni-Cd cells are subject to manufacturing variations.

Since the nickel-cadmium cell is basically an electrochemical system, some of the variations are quite subtle, but when

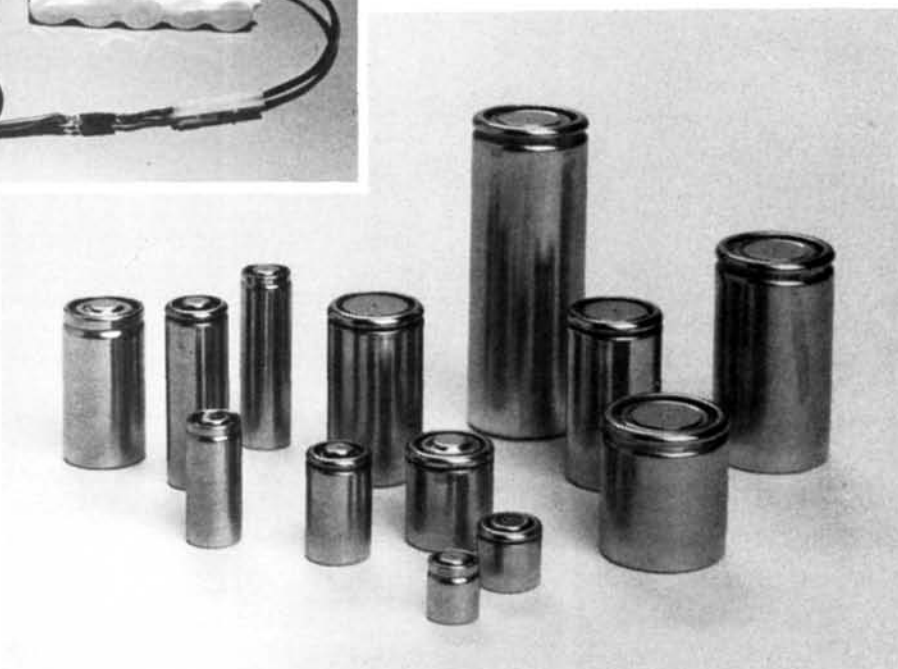
combined with hundreds of other variables (yes, hundreds!) that affect the eventual performance of the cell, we can end up with significant variations in a number of performance parameters. Capacity, voltage delivery (internal resistance), charge acceptance and charge retention (to name only a few) continue to vary even after the manufacturing has been completed. Depending upon usage patterns, charging regimes, discharge rates, depths of discharge and the environment encountered by the cells, performance will continue to vary.

These variations are further compounded as the cells age. At the time of manufacture, the cells are sampled to determine the spread of each production run. Over time, you might see a spread of +/- 15 percent about a norm. Most manufacturers rate the cells so that 99.6 percent of them fall at or above the minimum rating. This means that for a cell rated at 1.4Ah (this is the 1-hour discharge rate; 1.4 amps for 1 hour) anyone buying a running production lot could be assured that, on average, 99.6 percent of the cells would be 1.4Ah or greater. He could also expect that half of the cells in the lot would be greater



Left: It's very important to avoid over-charging your battery pack. By using a digital voltmeter, you can quickly detect when your battery pack has peaked.

Below: Rechargeable Ni-Cd cells come in many sizes and shapes other than the familiar sub-C cells. These cells are produced by Gates Energy Products.



than 1.7Ah and that four out of every 1,000 would hit greater than 1.9Ah.

But Where's All This Leading?

When cells are assembled into a pack, the capacity of that pack is limited by its weakest cell. When the capacity of that weakest cell is exhausted, the cell voltage goes to zero, quickly taking a 6-cell/7.2V pack to 6 volts with a noticeable reduction in a car's performance. If the discharge of the pack continues, the cell will develop a negative potential, so further reducing the voltage delivered by the pack. Obviously, if the cells are tested so that all cells in the pack have the same capacity, one would expect a better performance than from a pack of mixed-capacity cells. Or, further, selecting all the high-capacity cells and matching them in a pack could result in a 25-percent advantage over a pack assembled from randomly selected cells.

This is what the "experts" like to hear: that by matching cells, one is able to produce better racing packs and thus justify a premium price in the market.

The fact that a matched pack made of cells matched from the low end of a production distribution deliver less run time than a pack made of randomly selected cells might cause concern among modelers. Perhaps we should question the matching criteria used and consider the validity or logic of the matching procedure. In all fairness, the only advantage of matching might be to lessen the chance

for reversal when the pack is deeply discharged. Tests have shown that reversal at high discharge rates has minimal impact on the cell performance over hundreds of cycles. Matching alone doesn't necessarily result in premium, or "super," packs.

Packs must be constructed from those cells that have been selected from the high end of the distribution. The cost of matching is the same, regardless of the outcome of the matching process, so you might be paying a disproportionate cost for a pack constructed from cells selected from the lower part of the distribution while gaining no real performance advantage.

Unfortunately, there are some other facts regarding cell selection that can affect pack performance.

- Matching of cells at discharge rates other than the application rate is like judging a man's endurance for a marathon by testing his 100-yard-dash capability. The matching accuracy is reduced dramatically as the difference between the matching discharge and actual discharge increases.

- Once matched, cells will remain matched for their life is a nice concept, and, if it were true, it would make life so much easier. But life wasn't meant to be easy for the R/C enthusiast, and that's why radio interference was invented. Similarly, cells *don't* stay matched for life. As they're cycled, even in the same environment, they will begin to drift apart with each cycle. Even with the best matching

(Continued on page 67)

BUDGET RACER

RAIDER REVISAL

by DICK BRINTON

IN THE LAST ISSUE of *R/C Car Action*, I described how I track-tested Kyosho's* Raider and found that some changes had to be made: The car had a very bad push because the stock front tires are "all-purpose" and don't have the aggressive tread and soft compound necessary for a good bite on a dirt track. Consequently, every time the car went into a turn, the front tires lost traction and the car ran wide—very wide. In fact, the front-end bite was so poor that the only way around a sharp turn was by clamping on the brakes to slide the rear end around, and this isn't exactly the best method to use for quick lap times.

This "push" was easily corrected by swapping the stock fronts for a pair of Pro-Line* knobbies, which cured the problem instantly. As a matter of fact, the front-end traction improved so much that the car became very loose.

It's tough to drive a car that has poor traction balance, front to rear. If your car is way out of balance, a correct tire swap can produce the most dramatic change, and for big gains in traction, tire changes

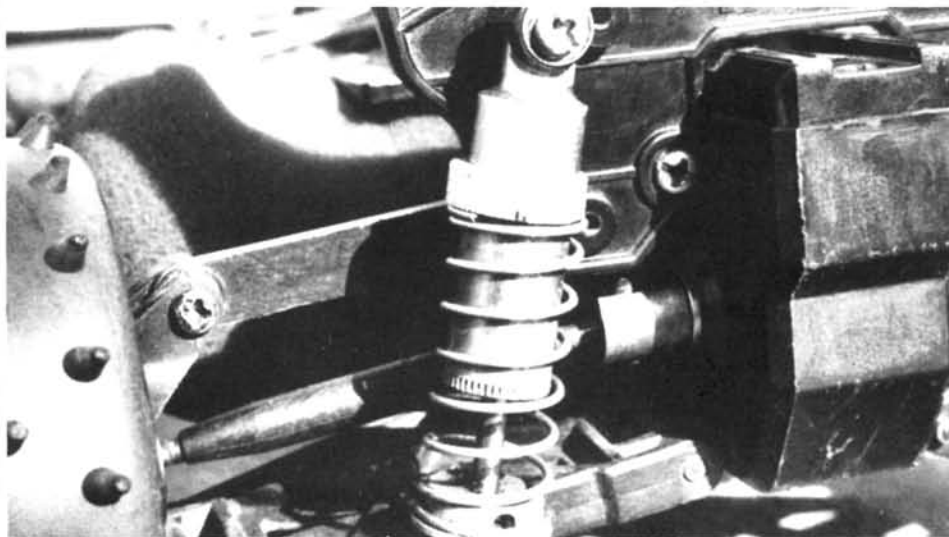
are the way to go. If you don't want to spend a lot trying various tires, use the ones used on the fast cars on your track, or read articles like this one where someone *else* has done the experimenting!

Once you're in the ballpark, you must be able to fine-tune your car yourself, because every car, driver and track is different, and there's no infallible all-purpose

Scott Hightower, his production winning Raider and "chief wrench," his father, Dana Hightower.



Yokomo C-4 front shock fits in place of the Raider stock rear shocks and really improves the handling.



recipe for good handling.

If you start with a reasonably good setup for a given track, you can make your car easier to drive by getting the traction balance, front to rear, correct. If you have too little traction in the front, the car won't want to turn. If you have too little traction in the rear, the car will try to spin out whenever it gets a little out of shape.

Generally, it's easier to drive a race car with too much traction in the rear (push), than with too little traction in the rear (loose)—even if you're Bill Elliott or Dale Earnhardt!

If your car is *almost correct* for the track on which you're racing, don't change tires to dial it in. A tire change at one end usually produces too much change, unless it involves only a softer or harder compound of the same tire.

To fine-tune your car, it's better to implement a less drastic change, i.e., spring pre-load, shock oil, camber, toe-in, caster, stabilizer settings or some combination of these.

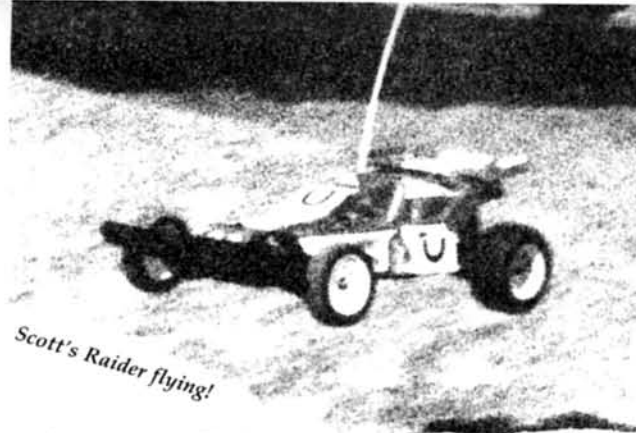
I'd like to be able to tell you exactly how each of these changes will affect your car, but that's impossible. For instance, when you dial-in more negative camber on a car that already has too much negative camber, the tires will *lose* traction instead of gaining, but if your car has too

little negative camber, a degree or so will increase traction. To further complicate matters, different tire designs respond to suspension settings in different ways. It all sounds like "Mission Impossible," but it isn't. Just make one change at a time, and check the effect each change had on handling. Resist the urge to "adjust" everything at once.

Fortunately for all of us, we aren't actually inside the cars, but if we were, it would be much easier to tell exactly what was going on. The only way to get the settings correct is by experimenting—a lot! Here's how all this applied to the Raider:

As previously mentioned, the stock front tires were changed for Pro-Line knobbies, which increased the traction dramatically, but then the rear tires wouldn't stick well. When needing a big change in traction, I usually change the rear tires, but since I knew the stock shocks weren't good enough to win races, I made this change first.

The stock friction shocks just don't provide enough control for the racetrack. A lot of the rear traction loss was a result of tire hop, which occurred when the stock



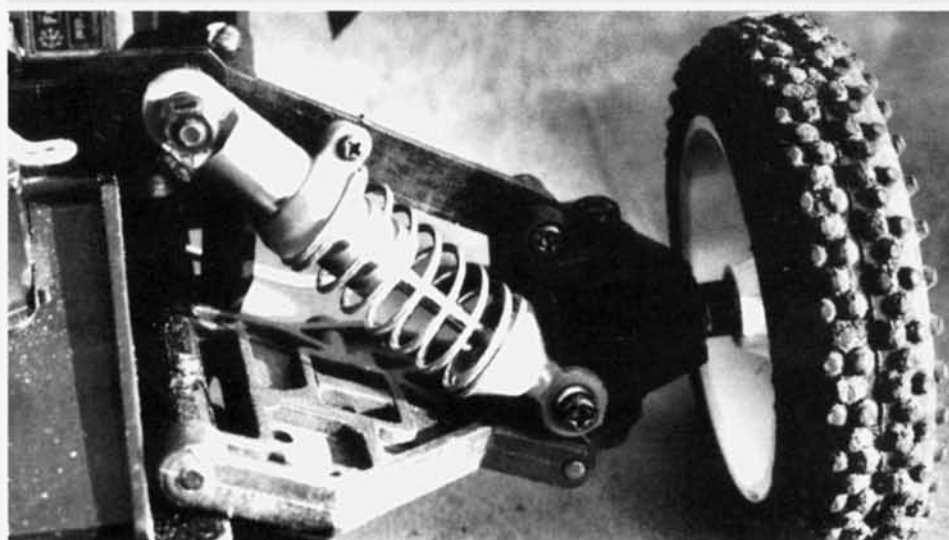
spring/dampener units just couldn't keep up with the track's roughness and jumps.

Using the stock springs, I installed Kyosho's Mini-Gold shocks at each corner. The Mini-Gold shocks are good-quality metal shocks that fit perfectly in place of the stock units. They provide adjustable-spring pre-load and oil dampening, and, so far, mine haven't developed any leaks.

When you assemble these shocks, leave out the red spacers, because the Raider's suspension works better using the full travel. The suspension movement with the Mini-Gold shocks measured 3cm (front and rear), which is the same front travel as with the stock shocks, but it represents a 15-percent increase in rear travel—a big-time gain! I went back to Sacramento Mini-Wheels super indoor layout and tested the Raider again.

This time, the car was much better than before, but it still wasn't right. The front end stuck OK, but it didn't handle the choppy parts of the track very well, and

(Continued on page 120)



Kyosho mini-Gold front shock with RC10 spring and Pro-Line knobby works well.

SCOPING OUT

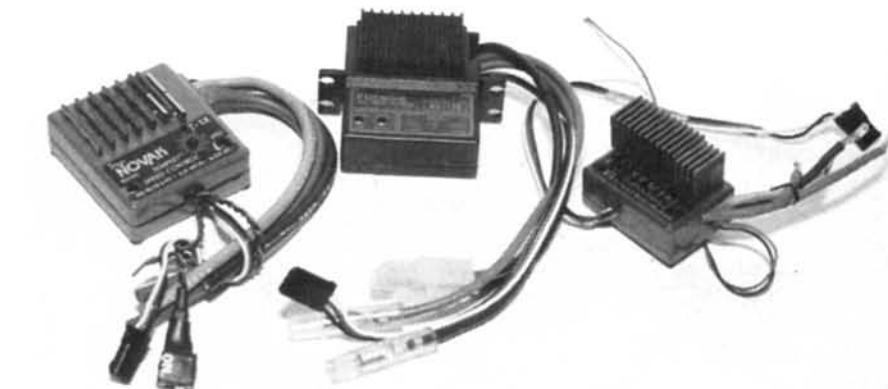
by JOHN RIST

WHAT, NO REVERSE?

WHY DO THE MOST expensive racing speed controllers such as the Tekin Pro and the Novak 1X leave out reverse?

It isn't because racing rules forbid the use of reverse, but because it would take a very large, very expensive speed controller to match the performance of the present forward-only racing speed controller.

To understand why this is true, let's discuss what makes the motors we use in racing run fast and what makes them run in reverse. First, the speed (or power) an electric motor puts out depends on the amount of voltage applied to the motor, e.g., a 7-cell, 8.4V pack runs faster than a 6-cell, 7.2V pack. Reversing the motor is simply a matter of reversing the voltage on the terminals of the motor. (If you swap the leads on your motor, your car will run backward when you tell it to go forward.) Second, an electronic speed controller uses a type of transistor called an FET (Field Effect Transistor), which acts as a switch to apply the battery voltage to your motor. This FET switch also varies its resistance as you press the throttle on your transmitter. High resistance causes a large voltage loss, which in turn causes slow speeds, but when the FET is turned on hard (full throttle), its resistance is very low, so there's minimum voltage loss. But even an FET has some resistance when



Novak's T-1X (left) and Tekin's Pro (right) are high-performance, competition, electronic speed controllers. The Futaba MC112B with reverse won't deliver as much power, but it's a good all-around speed controller for beginners.

turned on hard. A typical FET has a resistance of .015 ohm, which would cause an unacceptable .3V drop if your motor is drawing 20 amps.

With this in mind, let's look at a 7-FET racing speed controller that only has forward and brakes (Figure 1), and an 8-FET speed controller with forward, reverse and brakes (see Figure 2). In Figure 1, the racing speed controller places six of its FETs in parallel for forward and the seventh FET across the motor for the brake. When the braking FET turns on, it places a short across the motor and causes the motor to act as a generator that provides the braking action. The six FETs that pro-

vide the control for forward function in parallel to give a resistance of .0025 ohms (.015 divided by 6 = .0025), which would give an acceptable voltage drop of .05 volt at the 20-amp level.

Now for a look at the reversing speed controller (Figure 2). To obtain reverse, the FETs are divided into four groups of two. When the motor is running forward, FET groups A and B are on. If you follow this path, you'll see that the positive battery voltage is placed on the positive lead of the motor, and the negative battery voltage is placed on the negative lead. When the motor is running in reverse,

(Continued on page 74)

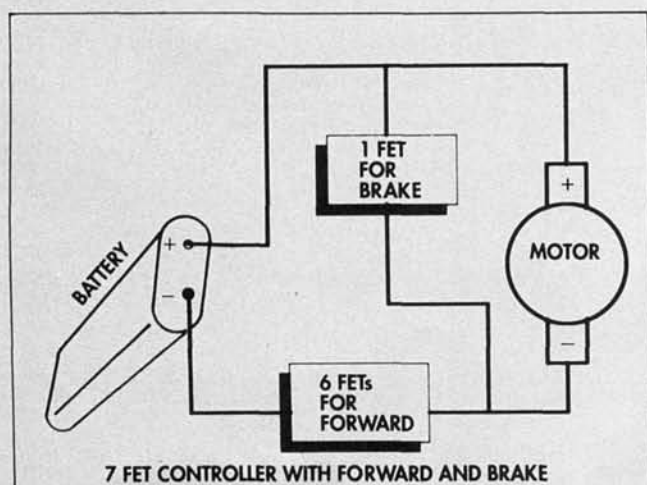


FIGURE 1

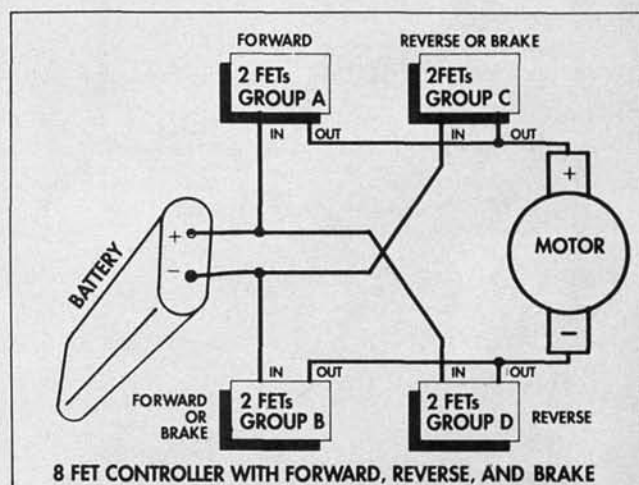


FIGURE 2

NI-CDS

(Continued from page 63)

techniques, there will be a difference. This difference will cause some cells to be more deeply discharged with each cycle, so changing their chemistry (electrochemical match) in subtle ways that will cause performance to shift.

- Early cycle performance variations are more pronounced, so it's recommended that cycle stabilization be achieved before any tests are made to quantify performance. *Stabilizing cycles before matching will usually give better results.* Usually, after about five charge/discharge cycles, things begin to settle down. The best way to determine when the cells are "stabilized" is by monitoring each cycle.

- Matching cells according to energy requires monitoring the voltage at a given discharge rate and selecting cells that have the same voltage at a given time. This gives an indication of the internal resistance of the cells, and it would be a valid means if voltage delivery at high discharge rates were the prime selection criterion. There's absolutely no correlation between the internal resistance and the deliverable capacity. Cells screened by the "quick 10-second method" would also require a subsequent capacity screen.

Cell manufacturers frequently employ this quick-look technique to screen out cells with low electrolyte, poor internal welds and other manufacturing defects. It's basically a check of the internal resistance of a cell, and it in no way reflects the capacity or run time of the cell.

- Cell matching by charge characteristic can be justified to ensure that all cells in the pack are capable of accepting the fast-charge regime used for R/C cars. Among other things, this technique requires monitoring cell voltages as a way of looking for high pressure in the cell (in a given lot, the cells with the highest end-of-charge voltage will have the highest pressure). These high-voltage cells are then punctured, and the pressures are measured to ensure that they're within design limits. This only ensures that the cells will accept a fast charge without venting. The efficiency with which a cell accepts a charge is another variable that we have to live with. (Some cell designs accept a charge faster than others.) Fortunately, cells of the same design and the same production lot are quite uniform in their charge acceptance, and this should lead us to a couple of conclusions:

Never mix cells of different or questionable age when building a pack. Date-code your cells, if they aren't already marked as you receive them.

Never mix cells from different manufacturers.

- Years of testing have shown *no correlation* between charge techniques and available capacity. Fast-charge, pulse-

(Continued on page 94)

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For Schumacher Cat. Hard compound tire will bite into a hard track and increase tread life.

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Reduced Sidewall Flex, Better traction. Fits 1.9" dia. wheels.

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Can be installed on almost any tire to improve traction on hard surfaces. Black spikes only.

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Direct replacement for Fox and Hotshot. Also fits Wild One, Big Wig, Boomerang, and 1.9" wheels.

4229 - CRP Dynamite Circle Tread

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4226 - Dynamite Round Spiked

Front tires for your 4WD on soft dirt tracks. Fits 1.9" dia. wheels.

4223 - Dynamite Front Tires

For Fox & Wild One. Spiked tread for medium to high traction requirements. Fits 2" dia. wheels.

4236 - Dynamite Pin-Spiked Tire

Rear tires with tall pin spikes and medium soft compound are a "Dynamite Combination!"

4238 - CRP Mini Pin Spiked

Hard compound, low profile rear tires really stick to difficult tracks.

4234 - Dynamite Spiked Rear Tire

Low profile and mini-spike tread gives extra traction for your RC10, Adaptable to Falcon, FX10, and Striker.

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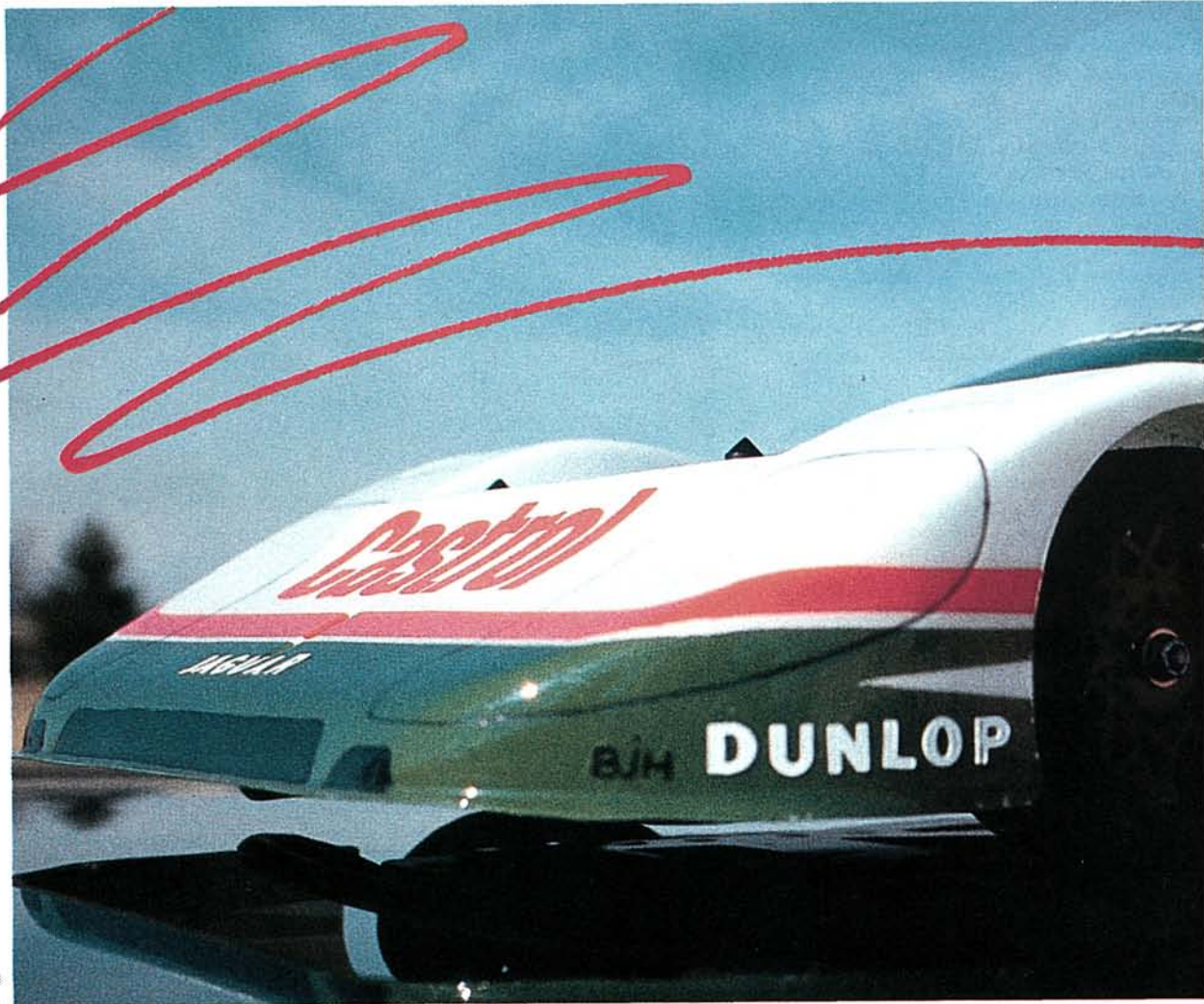
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AGITATOR

THE AGITATOR; the Alligator; the Instigator: These are all very good names for the new 1/10-scale on-road racer from Advanced Racing Technologies* of El Cajon, CA, but Agitator is the name chosen by Advanced. The car could have been called the Alligator, because it can chew up the competition, or the Instigator, because it will instigate a lot of discussion, since it's radically different.

The Lucas Agitator was designed and developed by Lucas Garneau, and the introduction to the 20-page instruction

manual explains that Garneau spent the last year and a half developing it. The distinctive look and the ease of assembly are ample evidence of the time spent designing and testing what's sure to be a competitive racer.

THE KIT: The Agitator kit is aimed at serious racers, so you won't find a body, wheels, tires, radio, speed controller or motor, because serious racers will prefer to choose these themselves. You'll find two ball bearings for each front axle, a whopping five ball bearings, and three blue thrust bearings for the rear axle. Oh, and did I mention the *graphite* axle? (No steel axle here.) All the chassis parts are made of fiberglass. For those who have the fiberglass version and want to switch, an all-graphite Pro kit and a Pro conversion kit are available. In all three





Low, lean and mean, the Agitator is hiding beneath an Associated Jaguar GTP body; ready to strike.

is the obvious care that has been taken in machining the fiberglass parts and Delrin plastic parts. Everything fit into place perfectly, and each hole was just where it should be. While the Agitator's design is complex, it still goes together very quickly.

Assembly starts with the front end, which consists of a cross-beam to which are mounted two A-arms. Each A-arm is supported by three standoffs, and the steering blocks ride up and down on coil-dampened kingpins. The

kits, the cross-beam that's part of the front end is fiberglass, and the flex of this piece is an integral part of the suspension. (Graphite wouldn't allow the front end to flex.)

ASSEMBLY: Building the Agitator didn't agitate me at all; in fact, it went like a dream. What impressed me most about this kit

supplied steering blocks use E-clips to hold the wheels onto the axle, but I replaced them with BoLINK's* threaded type, which use a nut to hold the wheels on. I was told that Advanced will include the threaded-type steering block in new kits. The kingpins run between the cross-beam and the A-arms. Because of

WILL '89 BE THE YEAR OF THE CAT?

by RICH HEMSTREET

AFTER FINISHING last year's 24 Hours of Daytona at the front of the pack, the Castrol Jaguar racing team must have thought that the IMSA GTP crown was within its reach. While the 24 Hours was just the first race of the season, the team gloried in the knowledge that it had beaten the dominant Porsche 962 contingent at a track that was ideally suited to Porsches. As the 1988 GTP season was played out, the Jag team continued to do well against the Porsches, but they were both blind-sided by the Nissan GTP ZX-Turbo.

For 1989, the Jaguar team has regrouped, and it's ready to take on both Porsche and Nissan. They'll continue to rely on their non-



Jaguar hopes this will be the year they capture the IMSA GTP crown with their XJR-9.

turbocharged 6.0-liter V-12 powerplants in their struggle against the smaller turbos of their competitors, and the Jaguar XJR-9 still carries Castrol Oil colors into battle.

At the '89 24 Hours of Daytona, a Jaguar had the lead late in the race, but it lost to one of the many Porsche 962 entries. While the team isn't off to as good a start as last year, team members at least know who their competition is this year.

For R/C racers, the Castrol Jaguar XJR-9 model will probably continue to be a popular choice for concours events. The decals are available from Parma, and the bodies are being produced in 1/10-scale by both Associated and McAllister. Many full-scale IMSA racers wish they could get their hands on one of the factory Jags as easily as R/C racers can get themselves their own—albeit smaller—version of this classic ride. ■

PHOTO BY MIKE LEE

ADVANCED RACING TECHNOLOGIES

LUCAS AGITATOR

Type: On-road racer
Scale: 1/10
Sug. retail price: \$320

DIMENSIONS:

Overall Length: 13 inches
Width: 9.375 inches
Height: 3.5 inches
Wheelbase: 10.375 inches
Front Track: 7.5 inches
Rear Track: 7.375 inches

WEIGHT:

Gross (w/bat.): 48 ounces

BODY:

Type: Associated Jaguar GTP
(not included)
Material: Polycarbonate

CHASSIS:

Type: Dual plane
Material: Fiberglass

DRIVE TRAIN:

Type (pri./sec.): 64-pitch pinion/spur
(not included)
Differential(s): Ball-type modular

SUSPENSION:

Front: Type: Individual coil springs
Dampening: None
Rear: Type: T-Bar on steel pivot balls
Dampening: Three coil-over
oil shocks

WHEELS:

Front: Type: Nylon (not included)
Dimensions (DxW): 1.875x1
inch
Rear: Type: Nylon (not included)
Dimensions (DxW): 1.875x2
inch

TIRES:

Front: Foam
Rear: Foam

ELECTRICS:

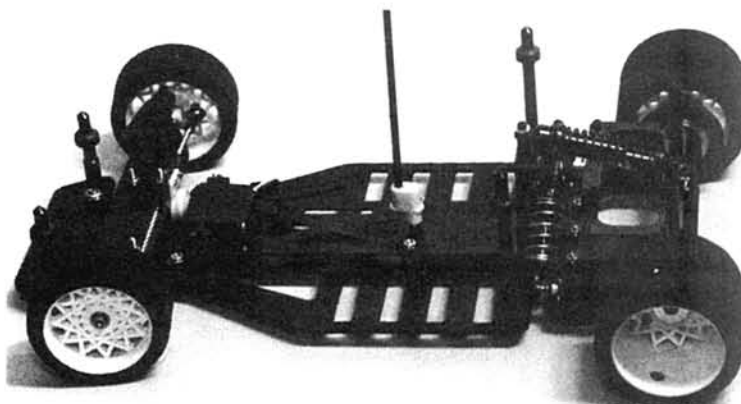
Motor: Team Checkpoint 20-turn
(not included)
Battery Req'd: 6- or 7-cell,
saddle-pack (not included)
Speed Controller: Electronic
(not included)

OPTIONS AS TESTED:

Futaba Magnum JR Radio w/S132H
Servo, Novak 4-speed controller, Litespeed
Litesink, TRC BBS wheels, Paragon graph-
ite antenna.

COMMENTS:

Awesome! Beautifully designed and machined car. Two minor assembly problems; otherwise, very easy to build. Since it doesn't have tires, body, gears, etc., serious racers can customize the car to suit their particular needs. Expensive and slightly overweight, but very competitive.



The dual-plane chassis and the triple coil-over shock setup are distinctive characteristics of the Agitator.

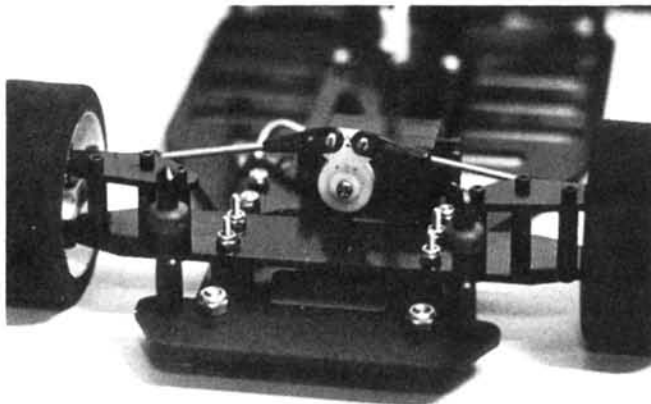
this design, there's no way for a kingpin to snap off, but this is a problem with some other cars on the market. The kingpins in my Agitator kit were the smoothest ones I've ever seen, so no polishing was needed, but you might like to apply a drop or two of light oil to make the steering block glide effortlessly up and down.

The cross-beam assembly is attached to the chassis plate with a unique Delrin saddle-block pivot. This is how camber and caster adjustments are made, and this step is also where I had the most trouble. While every other construction step in this kit is very well diagrammed, the instructions were of little help here. I called Gerry Pfeiffer of Advanced Racing Technologies and was told that the newer copies of the manual have been improved. I had, in fact, assembled the saddle-block pivot upside-down, although it looked good to me. Gerry explained the procedure for properly installing the saddle-blocks. Be careful when you install the screws in the saddle-block; they're threaded, so make sure that all the screws are tightened to the same degree. Partially tighten one screw, then the other, and so on, until the saddle-block is snugly seated on the pivot block and the pivot block is level and firmly set against the chassis. Repeat this procedure on both sides. Fine-tuning of the suspension is explained well in the manual.

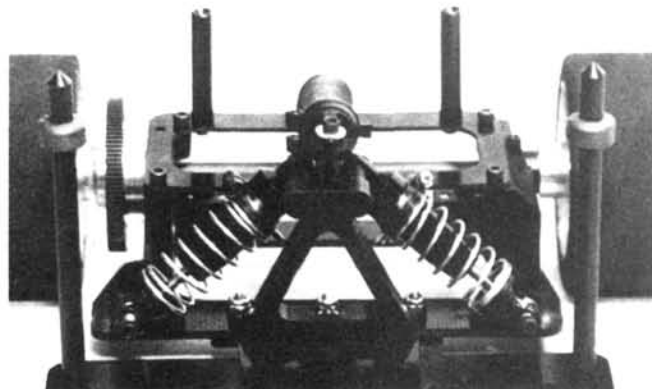
The rear end of the car consists of a T-bar that attaches the rear pod to the chassis. Actually, the T-bar is linked to the radio tray with a pair of pivot balls, and this allows for the side-to-side movement of the rear pod. The T-bar is attached to the bottom of the rear pod using three 4/40x1/2-inch flat-head screws, cone washers and O-rings.

The most interesting part of the rear suspension is Advanced's use of three, large, oil-filled shocks. Two short shocks go from a Delrin shock bridge to each side of the pod, while the long one goes to the upper rear of the pod. The assembly and mounting instructions are very straightforward, so there's no need to discuss them here, but one point should be clarified: In step No. 10, the manual says you should install the shock-mount brackets with the tabs facing forward and to the outside, but in fact, they should be installed with the tabs to the rear and to the outside. Otherwise, the steel ball mounts for the bottom shock mounts will hit the end of the chassis. The kit originally included fuel tubing instead of the ball mounts, and this wouldn't have caused a problem. The addendum to the instructions didn't mention this.

The included pressure bladders are a nice touch, and they made me smile. These bladders (or gaskets) fit into the top of the shock.



A lower crossbeam and independent upper A-arms make for a bullet-proof front end. The front body mounts are located on the small bumper.



The two short rear shocks control the T-plate tweak and roll. The rear body mounts are attached to the main chassis.

They give the oil a place to go (other than out of the shock) when the shocks are compressed. These bladders aren't expensive, but they really show that the manufacturer thought of *everything*. The three-point suspension lets you control the amount of dampening on the rear of the car; to stiffen or soften the rear suspension, you just have to adjust the collars. (It's also the way you set the rear tweak.)

The right and left bulkheads are also made of Delrin. I've replaced the one on the right side with the RC-12L Litesink made by Litespeed*. I don't think the plastic motor mount allows enough cooling for the motor. There are a few extra holes already drilled in the upper and lower pod plates, and Advanced might have had this in mind when they made the plates. These RC-12L Litesink holes will line up perfectly with the other holes. The kit comes with three cams, so the ride height of the car can be altered to suit track conditions. Advanced recommends that you use the middle cam as a starting point.

The five-bearing, modular, graphite differential finishes off the rear of the car. This is a very smooth diff that's helped even further by the inclusion of three thrust bearings and a Delrin spacer. The wheel hubs are spaced perfectly, but in many other kits, it's up to the racer to try to ensure everything is spaced correctly. Again, it's not a big deal, but it shows someone was thinking when the car was designed.

The Agitator kit is topped off by four beautifully machined body posts that have adjustable collars. These posts look unbreakable and will definitely remain straight through many severe collisions. I added a set of Body Foams made by Dan's RC Stuff*. These pads protect polycarbonate bodies from cracking and splitting at the mount holes. Delrin wing tubes are included for those who use a wing. Finally, I substituted a hollow, graphite, roll-over antenna from Paragon* for the plastic whip antenna tube. In the event of a crash, this type of antenna will usually flip the car back onto its wheels.

For radio gear, I chose my trusty Futaba* Magnum Jr. transmitter with an FP-S132H servo for the steering and a Novak* 4 Electronic Speed Control. I installed a Checkpoint* Platinum Series 20-turn motor with a Trinity* 23-tooth pinion gear and a Robinson* 115-tooth spur gear. TRC* BBS wheels with green compound tires were chosen as a starting point.

The body is the new Associated* Jaguar GTP. Using Wizardry spray paints and Parma's* Castrol decals, my expert body painter, Bill Henning (of Henning Scale Models in Lansdale, PA), was able to create an exact replica of the Castrol Jaguar.

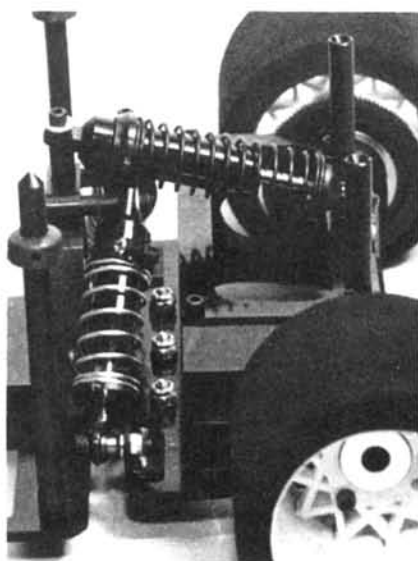
PERFORMANCE: At 48 ounces, I think the Agitator is the heaviest in the 1/10-scale on-road class. I couldn't wait to see how it would perform, and I took it to the track for an initial shake-

down run. The tight, twisty roadcourse with its 65-foot straight was an excellent test site, and the Friday night open practice session showed me a couple of things. After a few laps to get used to the car, I was turning some respectable times, and the Jaguar body, combined with the Bud's* Racing Products bi-level wing, proved to be very stable. By adding a little more caster (tilting the kingpins back), I made the car slice sharply through the turns without any tendency to spin out.

On the following Wednesday, the Agitator had its first taste of competition. After two hotly contested heats, I was able to grab the outside front-row qualifying spot in the A-Main. The field consisted of a Viper, my Agitator, an Eliminator and a Pro-10. The start of the race saw a first-turn wreck involving all four cars, but the Agitator came out of the tangle worst and wound up over the barrier. When returned to the track, the Bud's wing was turned sideways. After a pit stop to remove the wing and another to reinstall it (the Agitator spun out at every

turn without it), I made up at least three laps on the field. I still took 4th, but was only one lap out of 1st and on the same lap as the 2nd- and 3rd-place cars.

(Continued on page 126)



At the rear, you can see some of the nice design work that went into the Agitator. The triple shocks really work well.

POLE POSITION

by RICH HEMSTREET

TIME HAS COME FOR A NATIONAL CHAMPIONSHIP POINTS SYSTEM



High-banked oval-track racing will provide the backdrop for the 1989 Pole Position National Championship.

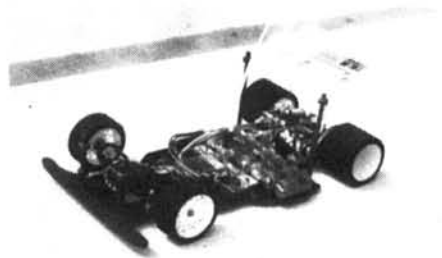
RADIO-CONTROL racing needs a new system of determining national championships. Basing a national championship on the results of a single weekend of racing was fine when the sport was small, but the sport has grown so large that I feel it would be better served by determining the national champions by a series of races. The obvious initial benefit would be an increase in fan interest in a continuing-points series aimed at crowning a National Champion. This could lead to media attention from outside the R/C industry, and that, in turn, could bring sponsorship money from companies outside the industry.

If nothing else, it would remove some of the "racing luck" that can play a major role in determining single-race national championships. By requiring participation in a series of major events, it would reward consistently good performances. This is what NASCAR and CART do every year in full-scale racing: Darrell Waltrip won the Daytona 500 this year, but he's still a long way from becoming the NASCAR Winston Cup Champion. Last year's Winston Cup Championship

was decided at the last race of the season.

The two biggest drawbacks to a national series are the coordination of the events and a hesitancy to make racers travel to several events in search of a national title. A race-sanctioning body has to tackle the job of coordinating a national series. After some early hopeful signs for '89, the most likely national series has been put on hold till at least 1990. The travel problem isn't as serious as it appears to be, especially where the top drivers are concerned. Many of these drivers already attend most major events, even when there isn't a national championship at stake.

To respond to the problem, this year, I'll institute the Pole Position National Championship for 1/10-scale on-road oval racing. I hope this championship can serve as a prototype for a true series in 1990. I'm still working out some of the details, but there will probably be three different champions crowned: an Expert or Invitational Champion, a Modified Champion and a Stock Champion. Some races don't use the invitational class, so it will take some work to separate the results. As presently planned, all drivers at each event



Part of the Pole Position Championship will include a manufacturer's title. Team Associated's new 10L (top), the Hyperdrive 10 (center) and TRC's Pro 10 (bottom) are some of the chassis that should be in the hunt for the championship honors.

will earn points according to their finishing order in the Mains. The TQ in each class will also receive a bonus point or two.

The tentative schedule for the '89 Pole Position Championship Series is as fol-

(Continued on page 128)

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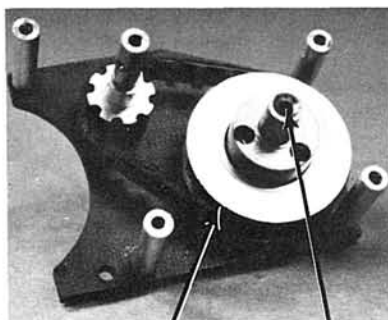
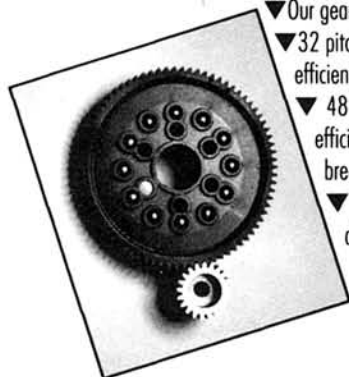
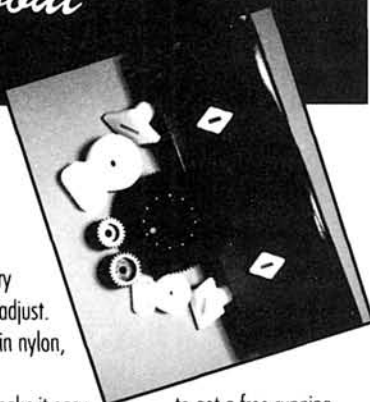
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SCOPING OUT

(Continued from page 66)

FET groups C and D are on. If you follow this path, you'll see that the positive battery voltage is placed on the *negative* lead of the motor and the negative battery voltage is placed on the *positive* lead, so causing the motor to run backwards. Brakes are applied by turning on FET groups B and C, which places a short across the motor. To win a race, the "on" resistance of FET groups A and B is the major concern. Groups A and B have only two FETs in parallel, with a resistance of .0075 ohms each. But to make matters even worse, FET groups A and B are *in series*, which causes their resistances to combine for a total resistance of .015 ohms. This would cause a loss of .3 volt at a 20-amp load. Now, .3 volt doesn't seem like much of a handicap, but this amounts to a 3.6-percent loss of voltage. The racing speed controller with its loss of .05 volt has only a .6-percent reduction in voltage.

I've used the Futaba MC112B with forward, reverse and brakes in the 2WD



Electronic speed controllers that are designed for competition don't have reverse built in. Novak's new T-4 is made for fast-forward only, and it doesn't carry any extra FETs for reverse.

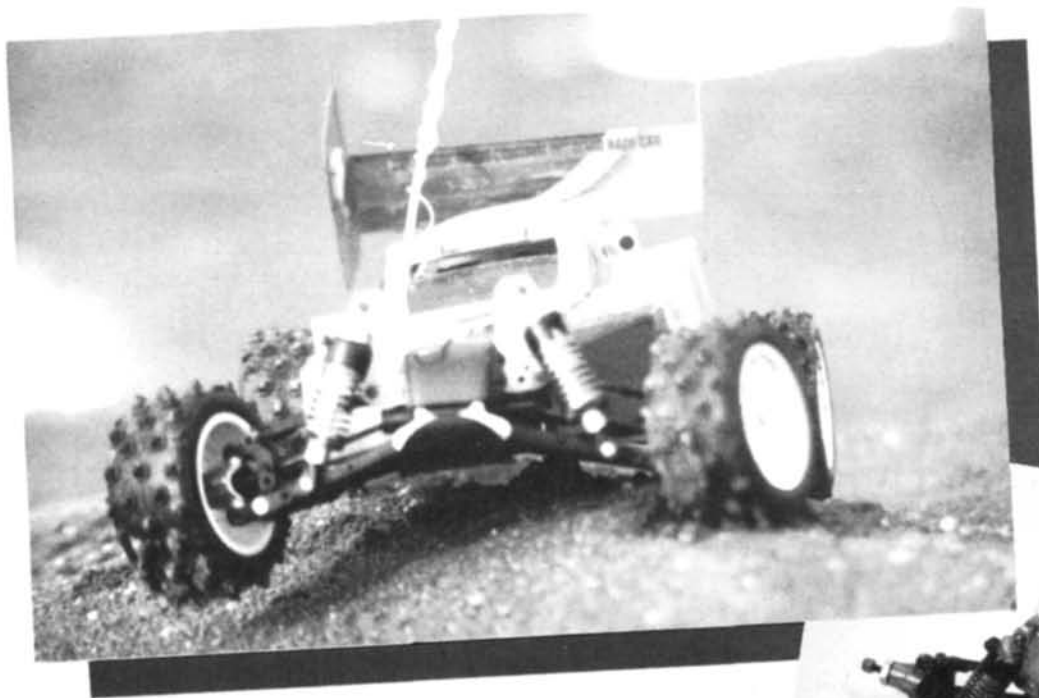
stock class, and the Tekin ESC 170 P Pro with forward and brakes in the 2WD unlimited class. Both were easy to set up and have performed well. My best result to date is an A-Main 1st-place finish in stock, and a 2nd-place A-Main finish in modified. If you're running in the stock class or running just for fun, the reversing speed controller is great. If you run in the unlimited modified class, or if you're racing any car or truck that requires heavy current, the high-performance, forward-only speed controller is well worth the extra money. When shopping for a high-performance speed controller, look for one with no more than a .03V drop at 12 amps.

One word of caution: Don't try to fix or modify an FET speed controller. The FET transistor is very sensitive to static electricity and will be destroyed if touched with an ungrounded soldering iron or soldering gun. If you have trouble, all manufacturers provide a reasonably priced repair service.

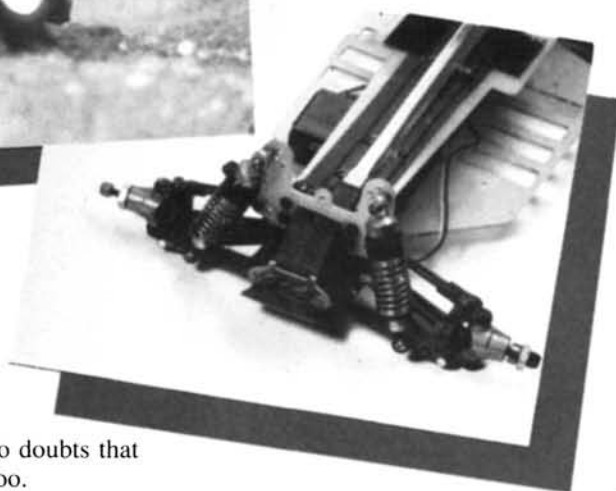
STRETCHING THE OPTIMA MID

JG PUTS THE MID ON THE RACK!

by
BILL O'BRIEN



Right: With the new fiberglass shock towers (front and rear), the Mid is not only lighter, but also has more shock-mounting options.



RACING CARS aren't pulled from their boxes all polished and ready to win the Intergalactic Championships. It would be nice if they could be, but a good R/C race car comes to life very much like a carving from a block of fine spruce. You hold it, you live with it for a while, and you shape it into what it should be.

The Kyosho* Optima Mid's 10-inch wheelbase is the shortest of any car I own by at least 1/4 inch. To me, the Mid has always seemed a little jittery in hard cornering—a cross between a psychotic spider and a crab with St. Vitus' dance. Apparently, I'm not the only one who feels this way, because several companies (including Kyosho) are marketing a replacement stretched-chassis kit for the Mid. I had just finished converting one of my Mids into a monster truck with a kit from JG Manufacturing*, when I noticed in their catalog that they also have a long-wheel-

base kit. The truck conversion was very straightforward, so I had no doubts that their stretch kit would be, too.

I opted for the \$65 G-10 fiberglass version of the kit (there's also a graphite conversion chassis for \$129) and got a wider, lower chassis with saddle-pack battery cutouts, an upper radio tray, a longer replacement drive belt, upper and lower Lexan belt covers and battery hold-down tabs. Another \$18 buys you a new body that will fit your soon-to-be-longer chassis.

I have only two complaints about this kit: The Lexan belt covers have to be cut from a molded Lexan sheet, and the cutting lines aren't easily visible. It's best to do the final cover trimming on the car. My other complaint is that there are no sealing tape or sealing pieces for the belt covers to replace the original Kyosho parts that no longer fit or are destroyed when the origi-

nal covers are removed. Electrical tape and Kyosho's part No. OT-103 tape bag cured the latter problem.

Changing the chassis on the Mid is the equivalent of disassembling the majority of the car. The JG parts almost fall into place, but about 3 hours of work is involved in removing the differential assemblies, replacing the belt, and transplanting the steering assembly. (While I converted a stock Mid and will be running it with just this one modification until I can assess what more is needed, if you have plans to add one-way or ball differentials, to save time, do that when you install the stretched chassis.) Other than the chassis kit, the only change I made was the replacement of

(Continued on page 78)

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STRETCHING THE OPTIMA MID

(Continued from page 76)

the stock Gold shocks with Kyosho Platinum.

Pan-head screws are used throughout the lower chassis, and these are countersunk into the fiberglass plate. The two metal stanchions and the original Mid bulkhead for the radio tray are carried over to the stretched version. The extra width of the new chassis gives you more leeway for servo

installation, but JG hasn't pre-drilled the chassis for the steering servo mounting blocks. You'll have to do that for yourself, but it's easy. Just use the servo you had on your Mid, and, for reference, put some masking tape across the bottom of the mounts. Punch themounting holes through the tape, and draw the edges of the mounts on the tape. Peel the tape off, position the servo on the chassis, and draw the edges of the mounting block on the fiberglass. Match the reference marks on the tape with the ones on the chassis, and you have perfectly aligned holes.

When you're all done, you'll have an Optima Mid with an 11-inch wheelbase. (And I hope you haven't tossed out your Mid manual, because the JG instructions aren't much more than an exploded-view diagram and, while helpful, they aren't quite as comprehensive as they might be.)

PERFORMANCE: Since the object of this conversion is to eke out some performance gains, I was anxious. I took the Mid

up to my roof (roofs are greatly overlooked race-courses)—spiked tires and all—and I ran it on the tarred surface. This is the worst of all conditions for an off-road car. The spiked tires can barely get purchase on the flat, hard tar.

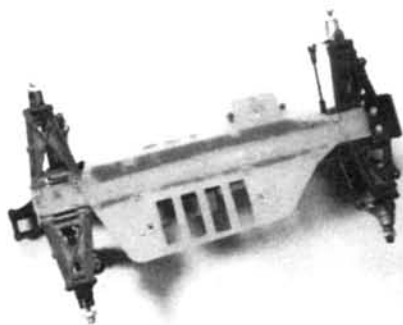
I put the Mid through a series of tight S-curves, followed by rolling double-backs and figure eights. The car skidded all over the place. (I couldn't have been happier!) When I had tried this with the unmodified car, it had

hopped sideways like the aforementioned crustacean and arachnid, but now it held and slid, even on tar, no longer throwing out its rear end on the turns.

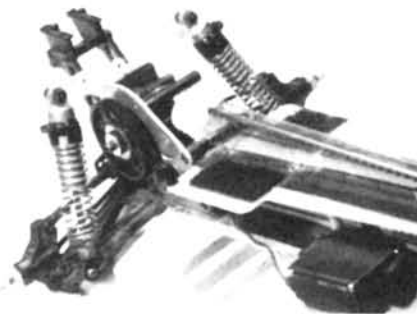
Downstairs on my test carpet, something else was apparent. The Mid's handling had changed: It was no longer jittery over bumps and through turns, but had slower, more precise control, and even understeering now that 1 inch had been added to the wheelbase. On a 4WD car, that reaction implies that the front end is

working harder than the rear. If I let up on the throttle, the steering reverted more to neutral, and this is just about how you handle a turn—easing into it and then powering out at the apex. Still, there's a

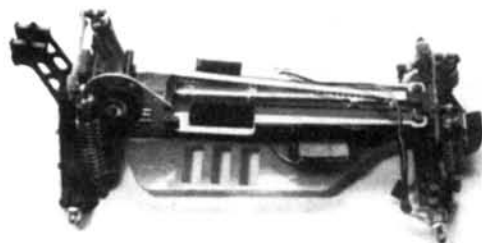
(Continued on
page 148)



For smoother, more snag-free running, all the screw holes on the bottom of the chassis plate (except the servo screws) are countersunk.



The wider section of the new upper chassis plate allows installation of the receiver and an electronic speed control. This was quite a task on the original chassis.



With the exception of the obvious saddle-pack cutouts, the Mid doesn't look appreciably different, but the conversion has afforded much more stability.

PROJECT BLACKFOOT



by STEVE POND

ALTHOUGH I HAVEN'T counted, I'm prepared to bet Chris Chianelli's toupee that the Blackfoot from Tamiya* is the most popular R/C truck on the market, and, along with the Marui Big Bear, the Blackfoot can claim to have *started* the monster truck craze.

Chassis components are primarily those of one of Tamiya's popular early off-road offerings—the Frog—but, while the Blackfoot is tremendously successful in monster truck races, design flaws reduce its potential for becoming a *real* threat in the A-Main.

The most obvious flaw in the Blackfoot's design (and we receive a *lot* of letters about it) is a direct transplant from the Frog. The dogbones that connect the differential to the rear wheels will round-off the hex-shaped ends in anywhere from a day to a month, so crippling the

SCREAMING FOR VENGEANCE



tuning your suspension to prevailing track conditions. A set of Kyosho Gold shocks was originally slated for use on the Blackfoot, but they were too long to attach to the original mounting positions and would have inhibited suspension travel. The only practical choices were the Tamiya oil-dampened units that are available separately for this particular application. (JG Manufacturing* offers a fiberglass set of replacement shock towers for the Blackfoot, and these allow the use of Kyosho Gold shocks or Associated's* RC10 shocks.) The Tamiya shocks have the same features as the Kyosho shocks, including pressure gaskets to prevent air from entering the chamber. The main difference between them is that the Tamiya shock body is molded of plastic instead of aluminum, and this allows the shock body to expand under heavy loads, which will change the dampening rate. However, for this type of application, the minor change in the dampening rate shouldn't be a problem. The shocks come with two different spring sets and a bottle of oil. While this oil is useable, its weight isn't specified, so if you need to make a change, you won't know what weight you should change to. I used Robinson Racing* 15W synthetic oil, and this proved to be a good starting point.

With the shocks assembled, I began to modify the suspension. On the front end, I replaced the stock suspension arms with a set from CRP*. These look almost identical, but are molded out of a stronger material and have a brass insert to tighten up the clearance on the suspension pivots. These are installed with shims to take up the play between the suspension arms

truck until a replacement set can be installed. While these dogbones were usually up to the task of transmitting the power in the Frog, the stress imposed by the Blackfoot's larger wheels causes premature failure. Other areas need improvement, too, so a "Project Blackfoot" is definitely in order.

Whether your Blackfoot is already assembled, or you're considering buying a kit, these modifications will improve your truck's durability and performance at a relatively reasonable cost. If you intend to race, check your club's rules to make sure that all these changes are legal, but if you just want to bomb around your back

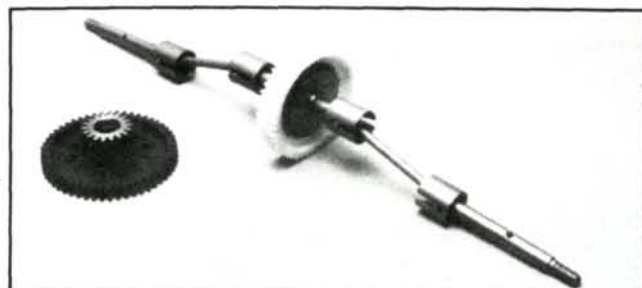
yard, then go ahead and have fun.

Truck Transformation

All R/C vehicles should have ball bearings (if your budget allows) so to begin the transformation, we installed a set. They reduce the rolling resistance of the truck (this allows longer running times and higher top speeds) and bring the tolerances in the transmission into a more acceptable range, so preventing premature wear.

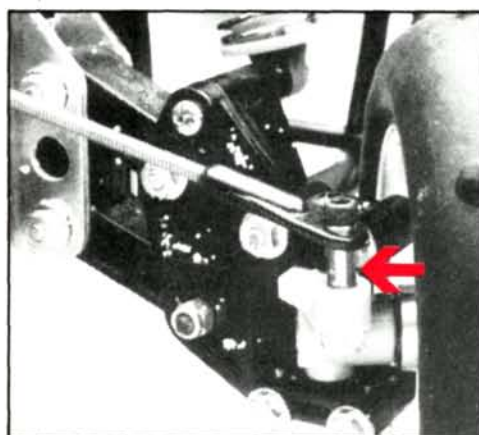
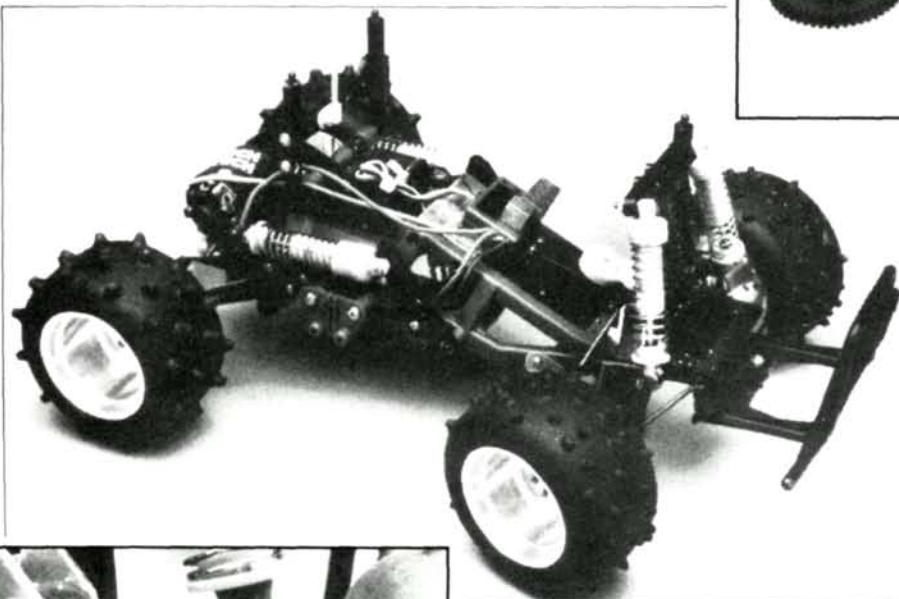
In place of the original "spring-dampened" shocks, oil shocks were installed, as these give more consistent dampening and more flexibility when it comes to

PROJECT BLACKFOOT



Above: The backbone of Project Blackfoot and the cure-all for the ailing stock rear differential are the Thorp diff, dogbones, and counter gear.

Left: Despite the tremendous improvement in performance, the Blackfoot chassis still retains its stock configuration.



By placing a shock-mounting bushing under the CRP steering rod before attaching it to the steering block, the steering rods sit at a more horizontal attitude, which reduces the inherent toe-in problem when the suspension is compressed.

BLACKFOOT PARTS CHART

Custom Racing Products: Part No.

Rear Suspension Supports	1606
Front Steering Arms	1607
Steering Kit	1617
Steering Blocks	1618
Rear Shock Mounts	1622
Battery Door Clip	2523
Antenna	3023
Rear Skid Plate	3045

Thorp Manufacturing:

Ball Differential	4500
Axles	4509
Dog Bones	4510

Tekin Electronics:

Pro Speed Controller	ESC 190
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Futaba:

Heavy-Duty Servo	FP-S131S
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Revtech:

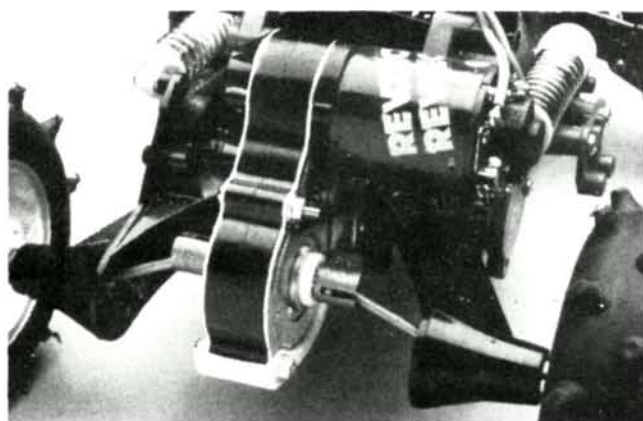
18-Turn Sprint Modified Motor	4183
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TMS Racing:

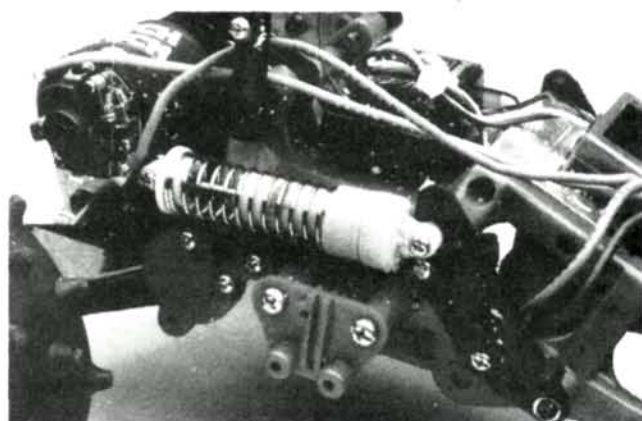
Small Spike Tires (front)	2202
Large Spike Tires (rear)	2203
Aluminum Wheels (front)	5001H
Aluminum Wheels (rear)	5002H

NMB Bearings:

Blackfoot Bearing Set	1024
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With the Thorp diff and dogbones installed, the Blackfoot was able to handle the power of the modified Revtech motor with no problem. Note CRP differential skid plate.



The Tamiya replacement oil dampeners are supported with CRP reinforced shock mounts for improved dampening, while the rear trailing arms are swinging on the CRP suspension braces for smoother action.

THE FOOT ROCKS ON

ONE OF THE MOST popular R/C monster trucks on the market, the Tamiya Blackfoot can be seen worldwide on just about any track, back yard, or sidewalk. The kit is relatively inexpensive, which makes it attractive to newcomers and, in most cases, it's durable and reliable. Where the Blackfoot *isn't* reliable, problems are probably the result of its ailing rear end. Nevertheless, consumers are still quickly snatching these kits off hobby shop shelves, and the large variety of available factory and after-market replacement and performance parts makes keeping the Blackfoot trackside as easy as ever.

Some of the features that made the Foot so popular are its trailing-arm rear suspension and its heavy-duty upper- and lower-link front suspension. The black ABS Ford F-150 body is not only well-detailed, but also allows the builder to produce a good-looking truck without having to paint it (the bright



red decal sheet and yellow wheels certainly helped out in the appearance department). The speed controller is one of the more reliable mechanical units: it's the stepped-resistor type with a BEC option.

While other 2WD monster trucks have been introduced since the coming of the Foot, none has become as popular. This might have something to do with the fact that, owing to its Frog ancestry, the Blackfoot has an advanced supply of after-market parts. Maybe it's a result of its lightness and good speed. Whatever the reason, this particular truck continues to enjoy a firm "Foot"-hold on the monster truck scene! ■

used. This steering kit includes 4-40 rod ends with pre-cut sections of 4-40 rod, and a heavy-duty servo saver that's much larger than those we're used to seeing on the average off-road car. The assembled steering rods were attached to the servo according to the instructions, but when attaching the rods to the steering blocks, I strayed from the instructions. Like the stock steering linkage, this CRP set also allows radical changes in the toe adjustment when the suspension is compressed. By installing a piece of brass tubing that was meant as a bushing for the shocks under the rod end, the steering rods are more parallel to the servo saver, and this won't allow as much change in the alignment under compression.

Moving towards the back of the chassis, the rear suspension received a little attention. First, I installed a pair of CRP rear shock mounts that are molded from a nylon-based plastic, as this provides a more solid mount than the original material. Just behind them, I installed a pair of CRP rear-suspension supports. These supports look identical to the stock supports, but they considerably lengthen the life of the suspension arms. The outer supports are molded in the same configuration as the original hardware, but the important extra is the support for the inner pivots that the original kit lacks. In the stock configuration, the inner pivots ride in a hole that's punched through the differential side plates. The edges of this hole are relatively sharp, and since this is all that supports the suspension arms, it could cut right through the pivot. A bushing is included in the CRP kit, and this fits be-

tween the aluminum side plates on the differential. This bushing offers considerably more support and greatly reduces wear. (I recommend this low-cost item.) However, even with the CRP supports, there was some binding that inhibited the movement of the rear arms, and this was caused by inadequate clearance between the diff housing and the outer suspension supports, which pinched the suspension arm. To increase clearance, I placed two 3mm washers between each of the four points where the diff housing is attached to the chassis. This widens the chassis so that the outer pivots aren't as tight on the

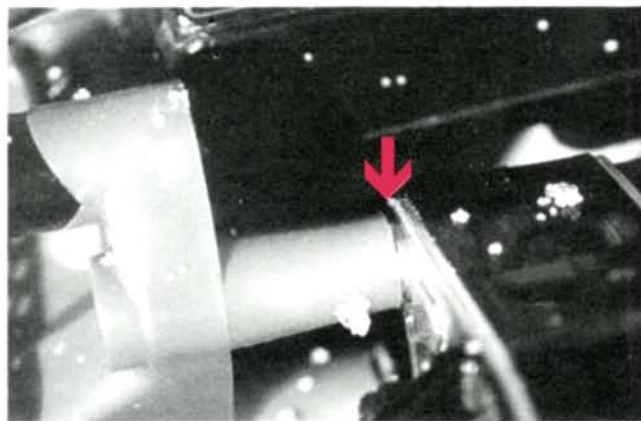
suspension arms, and this leads to smoother action.

But I've yet to mention the most significant addition to the Blackfoot's differential. Thorp Manufacturing*, which has been producing high-quality ball differentials for several years, also makes a conversion kit for the Blackfoot, and this kit enables you to do away with the troublesome stock equipment. While the stock differential hasn't been a chronic problem, it has been known to strip counter gears. The Thorp differential is also of the ball

(Continued on page 132)



the Tekin ESC 190 provided plenty of "go," while the Futaba FP-S131S servo and CRP servo-saver provide the "where to go."



To allow the rear swing arms to operate without binding, it was necessary to install two 3mm washers at each of the four points where the chassis attaches to the diff housing. This will spread the chassis enough to free up the trailing arms.

KYOSHO HONDA CRX

WELL, IN ADDITION to reaching all four corners of the globe, it appears that Kyosho* has also reached all four corners of our cars—in terms of drive components, anyway. We all know about Kyosho's full line of successful conventional 2WD cars like the Turbo Ultima, the 4WD Mids (like the Turbo Optima SE) and even the ground-pounding 4WD, 4WS monster truck, the Double Dare. So we're left with the question, "Where do we go from here?" Up front, naturally! Kyosho has decided to introduce to the

think there was no reason for locating the drive system *anywhere but* at the front end of the car. Even most domestic car manufacturers have seen fit to take this route in recent years. Why? Traction and interior room. The "people space" gains are achieved because there are no drive-shaft humps to deal with, so allowing the seats to be closer to the floor and creating more headroom in the same general space. So much for ergonomics; now to the traction issue, which is always of concern to racers. Front-wheel-drive, in and of itself, probably



by RICH URAVITCH

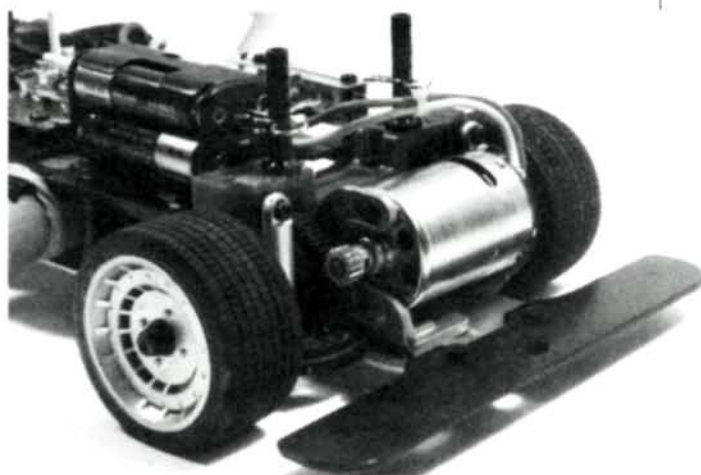
SO YOU WANTED FRONT WHEEL DRIVE!

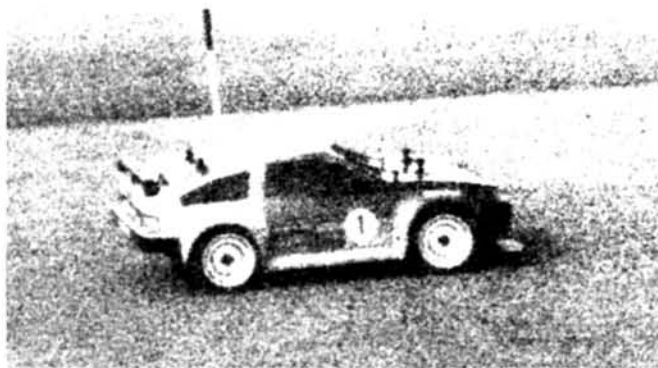
1/12-scale on-road scene a pair of front-wheel-drive, scale cars: the Peugeot 205, and the subject of this track report, the popular Honda CRX.

If you've listened to what all the Saab commercials have been saying for many years, you'd

has no real advantage over conventional rear-wheel drive—except maybe for straight-line, get-out-of-snow-or-mud

Hefty front bumper helps prevent "Lexan lumps," but, more important, protects the stock LeMans motor and drive train. With a BEC radio, the receiver dry-cell pack could have been eliminated and weight reduced.





traction because the engine weight is directly over the drive wheels. But this weight distribution can create a problem when you call upon the car to turn on unruly or wet surfaces (which is an occasional requirement!). The heavier front end that served you so well in your bogged-down adventures now becomes the very reason that the lighter rear end wants to seek its own path, which is not necessarily that of the front end of the car! The trick here is to make the weight distribution of the vehicle as close to 50/50 as you can *without* adding ballast or useless weight. By positioning the components to obtain the best practical balance, Kyosho has come close with the CRX.

THE KIT: The kit contains all the required components and materials, including grease, screw-locking compound and shock oil. You'll need the usual complement of tools like screwdrivers, an X-Acto knife, pliers and CA adhesive (I use Zap*). When it comes to final painting, you'll need your choice of colors and some method of applying them. A full sheet of colorful vinyl decals is supplied to add the finishing touches.

ASSEMBLY: This is covered by a well-illustrated, 16-page manual that has your Honda road-ready in 30 easy steps. An illustrated parts list is provided to help you identify some of the components during assembly and as a guide for ordering those inevitable replacements! All the parts are bagged by common usage rather than by assembly sequence. If this is your first R/C car project, you should use small parts trays (which you can number) to hold the parts while you're working. (A foam egg container works well.)

From start to finish (minus painting)

the Honda consumed about 10 hours of assembly time, which included some short interruptions for photography. It went together very easily and presented no real problems. The heart of the drive system is a stock LeMans 05 motor driving the front wheels through a gear differential. It's simple, and probably bulletproof, as it relies on mechanics that used to be located at the other end of conventional-drive cars. One other design feature that contributes to the positive handling of the CRX is the use of a 4-wheel independent suspension system with individual, oil-filled shocks at each wheel location. The double-wishbone arrangement is tried-and-true, but this is the first time, to my knowledge, that it has been employed on a 1/12-scale on-road car.

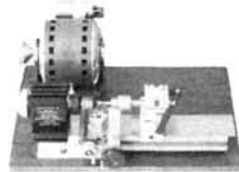
The radio used is an old (no longer available) Tower twin stick. It didn't have BEC, and I chose not to modify it, so I retained the use of the stock 4-AA pen-cell pack to power the receiver and servos. Eliminating this pack and using a BEC-equipped radio would make the weight distribution even better. The steering servo mounts with double-sided foam tape that provides good shock dampening but can alter the steering input somewhat as its position shifts owing to loss of some of the "sticky." Unfortunately, there's no other way to mount it in the allocated space. If your steering starts to feel different, or you're constantly re-trimming after running your car for a while, check the position of the servo and replace the tape, if necessary.

After trimming the Lexan body according to the instructions, I prepared it for paint by first washing it in a warm water/dishwashing detergent solution,

(Continued on page 88)

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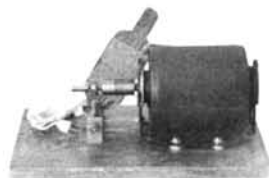


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CRX

(Continued from page 87)

drying it thoroughly and then masking the window areas. Then I scuffed the body lightly with 000 steel wool, as scuffing allows the paint to bond better. After this has been done, be certain to remove all the traces of steel wool from the surface prior to painting. To complete the finishing process, I used Parma* paints applied with an airbrush. The wheels were shot with silver paint to create the aluminum alloy look of the "real thing." Final detailing came in the



No, this isn't the rear end of the Honda going away from you; it's the front end coming at you! Nylon cable ties keep wiring in place.

form of a variety of sponsor decals and picking out the panel lines with a black paint stick.

PERFORMANCE: Running the Honda proved to be better than I had expected. The front-wheel drive provided different handling characteristics than conventional rear-drive on-rollers; it seemed to stick better, and it *definitely* could be driven deeper into sharp turns with much less "plowing" tendency. I'm sure the tires have a lot to do with this, as they seem well-suited to this application, since they're wide and have a good tread pattern.

Although I haven't yet had an opportunity to run the Honda against other 1/12-scalers, I'm confident that, with some final tweaking, the most important function of the Honda's rear end will be showing it to the competition!

*Here are the addresses of the companies mentioned in this article:

Kyosho; distributed by Great Planes Model Distributors, P.O. Box 4021, Champaign, IL 61820.

Zap; distributed by Pacer Technology & Research, 1600 Dell Ave., Campbell, CA 95008.

Parma International, 13927 Progress Parkway, North Royalton, OH 44133.

KYOSHO

HONDA CRX

Type On-Road
Scale 1/12
Sug. Retail Price \$179.95

DIMENSIONS:

Overall Length 12 3/4 inches
Width 6 3/4 inches
Height 4 3/4 inches
Wheelbase 7 3/8 inches
Front Track 5 7/16 inches
Rear Track 5 7/16 inches

WEIGHT:

Gross (w/bat.) 2 pounds, 11 ounces

BODY:

Type Honda CRX
Material Polycarbonate

CHASSIS:

Type Ribbed plate
Material Stamped aluminum

DRIVE TRAIN:

Type Pinion/spur
Differentials Planetary-gear type
Bushings Nylon

SUSPENSION:

Front and Rear Independent double wishbone
Dampening Oil-filled shocks

WHEELS:

Front and Rear Injection-molded nylon
Dimensions 1 13/16 x 1 inch

TIRES:

Front and Rear Hollow, pneumatic
Dimensions 2 3/8 x 1 inch

ELECTRICS:

Motor LeMans 05 Stock
Battery Type Req'd 6-cell, 7.2V, 1200mAh
Speed Controller Servo driven, 3-step plate

OPTIONS AS TESTED:

Tower Hobbies twin-stick radio

COMMENTS:

The front-wheel-drive system is used to advantage because of the weight distribution. The rear end has ample weight to keep the car glued to the track without breaking loose. Suspension components are hefty enough for their intended use.

NI-CDS

(Continued from page 67)

charge, pure DC, half-wave, full-wave, or high-frequency charge produce no *significant* difference. Assuming the cell is fully charged (all the active material in the cell is converted) and that the charge regime isn't abusive to the cell (causing it to vent), the cell will yield the same capacity, regardless of charge technique. Perceived differences are much more likely to be caused by temperature, previous depth of discharge, or some other phenomena. Taking cells into overcharge at high rates can result in venting, and this can reduce performance.

As cells reach full charge, the positive plate begins to generate oxygen. This oxygen is recombined on the negative plate, and we see the heat of this recombination as a cell-temperature rise. The faster the cell is charged, the faster the oxygen is generated. Unfortunately, not all of the positive plate is charged at the same time, and while the gas is being generated and recombined at a rate that causes a significant (even damaging) temperature rise, some of the positive material hasn't been fully converted (charged). A discharge attempted immediately after a fast-charge termination will yield something less than full capacity. That's why a topping trickle-charge is recommended to put

in the last 10 percent of capacity. Usually, the sooner you discharge a cell after charge, the more capacity it will deliver, although there isn't a significant measurable difference.

- Any vendor claiming that peak performance occurs between 14 and 30 cycles isn't totally off base, because at times, cycle testing supports this claim. Some cycling tests have shown a continual performance decline with each cycle, after the cells have stabilized, while others have even shown a performance *increase* with cycling for several hundred cycles. If nothing else, this is a good reason to occasionally run a discharge-check on your packs and to keep good records.
- The instructions from one manufacturer of chargers call for totally discharging the pack using a resistive load overnight *as a minimum*, and recommend *a week* for best results. In theory, this should get the cells to the same state of charge, but some of the cells may actually be driven into *reverse* while others are at a positive potential. The pack voltage under this resistive load may read zero, but remember that this is *the sum* of the individual cell voltages. Experiment for yourself: After leaving your pack on a resistive load (10 to 30 ohms) for 12 hours, using a straight pin as a probe to get through the sleeve, measure the individual cell voltages (while still connected to the load). Don't

be surprised to find voltages ranging from -0.5 to +1.2, while the pack voltage is close to zero. The reversed cells will accept a charge much more slowly than the cells that weren't reversed.

You'll also run a very high risk of venting the cell, as hydrogen is generated in the reversal process. This residual hydrogen, combined with the oxygen generated on the next fast-charge, further increases the risk of venting the cell. If you want to discharge a pack, discharge it at 100mA to a pack voltage of 5.4V and stop. This will accomplish the same results without the risk of reversing cells. Another technique places a diode across each cell in such a way that the cell can't discharge below the diode-dropping voltage of approximately 0.5V.

- Another rather barbaric custom calls for heating the battery pack so that it will accept a charge faster. Heating the pack causes a lower voltage, so that the pack *appears* to be charging faster as the current is higher in response to the depressed voltage. Two things are happening when you charge a Ni-Cd cell:

1. You're converting the active material in the cell to the charged state.
2. You're generating oxygen as areas of active material are completely converted.

These things happen at different rates

(Continued on page 106)

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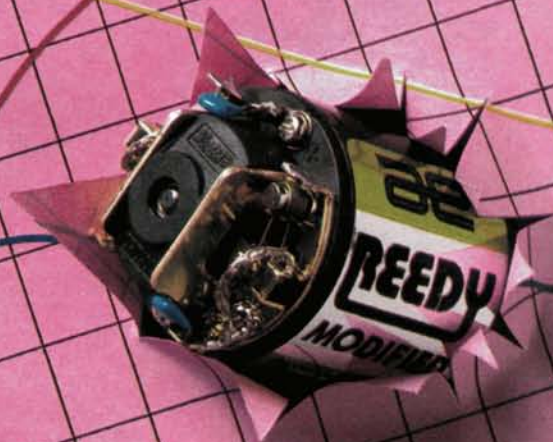
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(Graph shown represents actual readout of Reedy Modifieds motor.)



2585 Cadillac Ave

TRACK REPORT

by ERIC GOLDSCHRAFE

TRC

PRO 10



A close look at one of Car Action's top ten winners

TO A CASUAL participant in 1/10-scale on-road racing, the TRC* Pro 10 might seem overpriced and overdone; in reality, the car is well-made and features several innovations not seen on comparable cars. This makes the car very competitive right out of the box, needing only the addition of the R/C equipment, a battery and a suitable motor and body.

The Pro 10 is based on the car that won at Lake Whippoorwill, and it contains all the parts and innovations that were used on the prototype. There's no need to buy a bunch of other specialty pieces to make this car competitive, and you don't have to modify the parts in the box. This is a sophisticated racing machine, not a toy or an entry-level car, so if you only want something to race occasionally and fool around with on the street in front of your house, *don't* buy this car (even TRC tells you this).

THE KIT: A rather complicated instruction booklet describes in some detail the hand-fitting of the many parts that go into this model. It might seem like a lot of extra work when compared to many other mass-produced kits, but it's sort of like "blueprinting" a real race engine to get all the parts to fit perfectly. Each part is carefully matched with its mating surface by sand-

ing, polishing, or carefully aligning, and, if done correctly, the result is a chassis with absolutely no slop or tolerance build-up. If you aren't the type to spend several minutes or hours truing and smoothing some small parts, don't buy this car. But by making it yourself, you'll understand why the Pro 10 is such a good car.

In many respects, the TRC car is similar to most other cars: It has a flat, fiberglass-sheet chassis that's milled out and drilled neatly for lightness and accurate component mounting. The T-plate might look similar to that on some other cars, but the rocker setup and a pair of small coil springs make this design flexible, yet solid. There's no play to promote rear-end wandering, and if you take the time to fit everything together correctly, it works very smoothly.

A unique shock-mounting tower lets you set the angle of the shock to suit varied track surfaces, and the kit's shock absorber works effectively and smoothly. The front end is comprised of a beam axle with coil-sprung steering blocks, and the aluminum blocks used to mount this assembly to the main chassis allow for easy caster adjustment. This as-

(Continued on page 100)

TRC PRO 10

sembly might look like those you've seen on a couple of other cars, but it's much more substantial in comparison. No steering tie-rod linkage is included, but after all the trouble you go to with this car, it makes sense to install quality parts.

The rear pod might also look similar to those used on some other kits, but there are several details that make this a superior unit. One difference is the ride-height adjustment blocks that allow you to tailor the chassis to tire diameter and track requirements; another is the strong torque tube that houses the rear axle and contains the precision ball bearings. A graphite axle is utilized to mount what is probably the smoothest and best-made differential in the industry. Everything, including the spur gear and right-side hub, rides on ball bearings, and the several thrust bearings used allow precision adjustment and eliminate slop in the ball diff. The aluminum block used in this kit has motor slots machined into both sides so that any type of gear or belt-drive setup will fit, and it has also been drilled for wing tubes. When completed, the chassis is mounted on the TRC wheels and tires included with the kit.

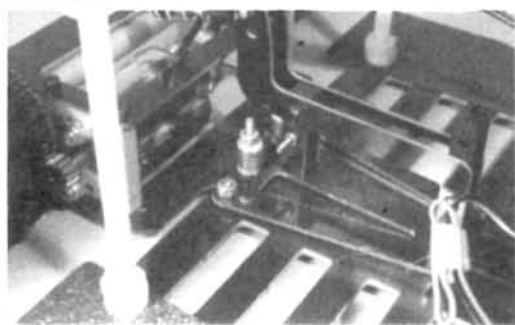
As previously mentioned, you'll need a radio, a battery pack, a motor and a body to complete this car, which is basically the same as most other 1/10-scale on-road cars. Just about any Can-Am-style or stock-car body will fit, and any small or standard-size R/C set will work.

The chassis was topped off with a NASCAR body to conform with the type of racing run by the *Car Action* team. An MRP* '88 Buick stock car was chosen, primarily because I hadn't done a Buick lately, and the MRP body looked nicely scaled down. Floquil* model railroad paint was mixed to the correct shade of apple green and airbrushed onto the masked-off body. The gold trim stripe was applied next, followed by white lower body panels. Autographics* decals were used for the Quaker State logos and Buick emblems, and the No. 26 on the doors and roof were handmade from Top Flite* MonoKote trim-sheet stock. All the trimming was also made with this material, as were the headlight doors, the grill, the panel striping and the window moldings. For that final touch, BoLINK* NASCAR decals were used on the front fenders, and then the car really looked ready to race!

PERFORMANCE: The *Car Action* racing team track-tested this car at our "home" track—Island Raceway, in Hauppauge, NY. We found that the car is all that's implied in the advertisements and factory literature. While the initial settings aren't covered in the instruction manual, they do tell you how to dial-in the car.

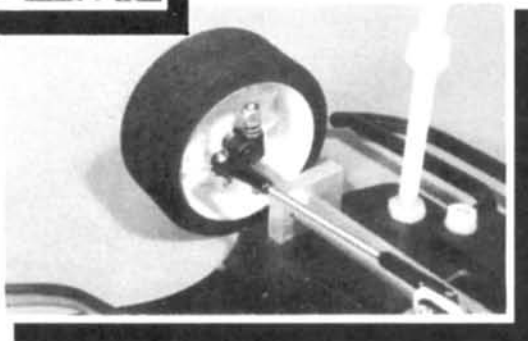
As a starting point, I set the front end up with about 4 degrees of caster and a little

(Continued on page 152)



Rear-suspension adjustments can be made both with the coil-over shock assembly and the two tweak/preload adjusters beneath the shock-mount bracket.

A heavy-duty beam front axle offers infinite caster adjustment. In the present kits, the steering blocks shown here have been replaced with a heavy-duty unit.



TRC

PRO 10

Type On-road
Scale 1/10
Sug. retail price \$260

DIMENSIONS:

Overall Length 14.5 inches
Width 9.5 inches
Height 4.5 inches
Wheelbase 10.5 inches
Front Track 7.25 inches
Rear Track 7.5 inches

WEIGHT:

Gross (w/bat.) 45 ounces

BODY:

Type Not included

CHASSIS:

Type Flat pan
Material Milled fiberglass

DRIVE TRAIN:

Type Pinion/Spur gear
Differential Ball type

SUSPENSION:

Front: Type Coil springs
Dampening None
Rear: Type T-plate
Dampening Coil-over shock

WHEELS:

Front: Type BBS, spoked
Dimensions (DxW) 1.75x1.125 inches

Rear: Type BBS, spoked
Dimensions (DxW) 2x2 inches

TIRES:

Front Foam (blue compound)
Rear Foam (green compound)

ELECTRICS:

Motor Not included
Battery Required 6 to 7 sub-C cells
Speed Controller Not included

OPTIONS AS TESTED:

Rev Tech stock motor, Futaba 2-channel radio, Victor speed control, Trinity steering linkage, MRP Buick stock-car body.

COMMENTS:

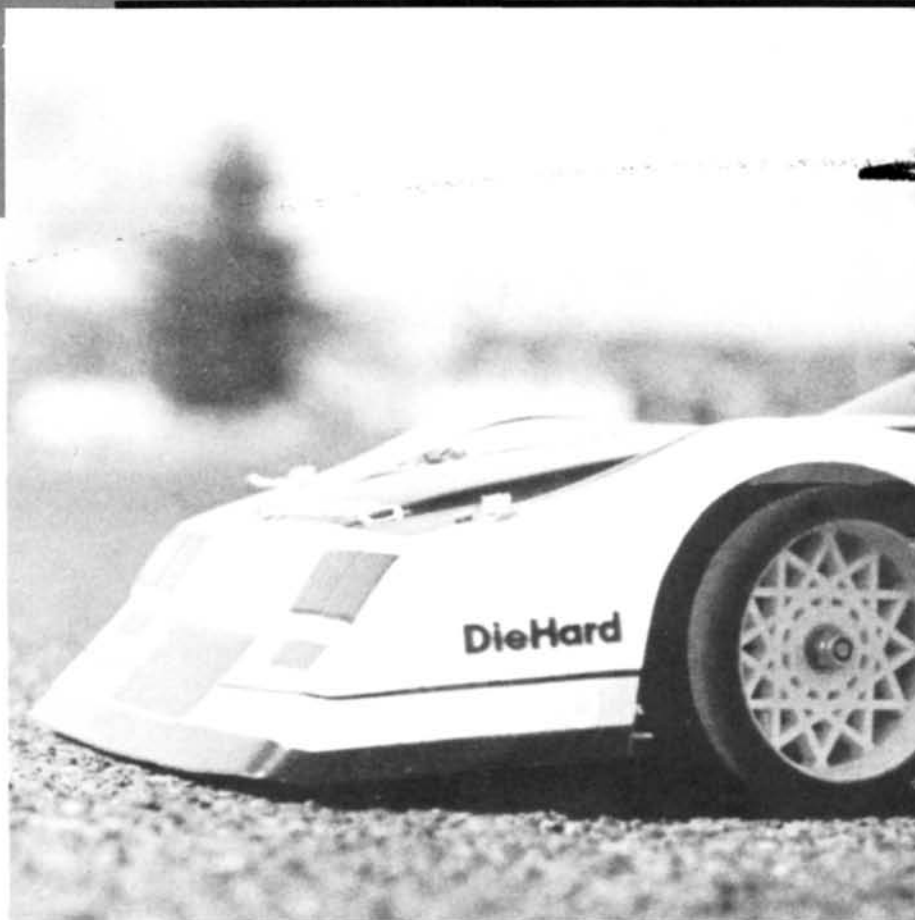
The Pro 10 is a competitive on-road car. While it takes time to hand-fit some of the parts, the effort is worth it. Both front and rear suspension offer fine-tuning so that you can dial-in the car on any track.

HIGHWAY HORNET



ROAD-HUGGER
FROM THE HIVE

by WALLY DAVID

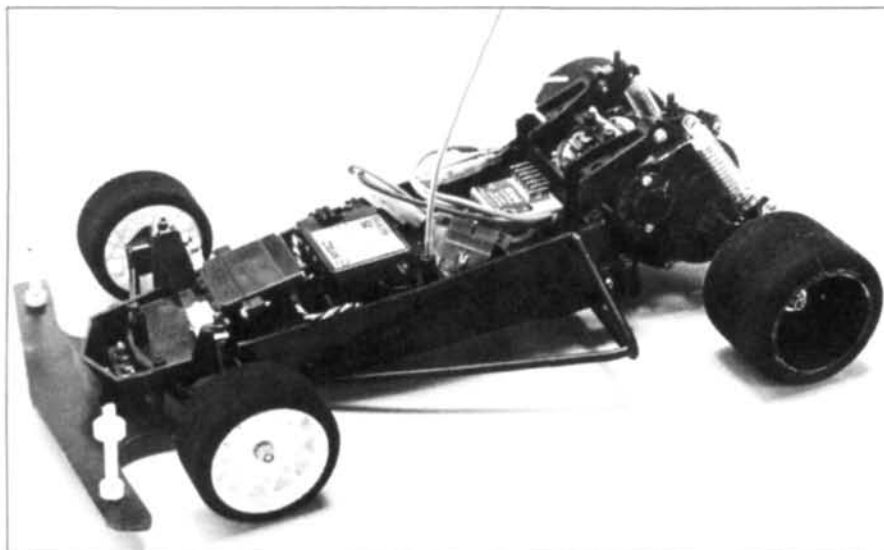


WHEN YOU THINK of $1/10$ -scale on-road cars, you probably first think of the BoLINK Eliminator, Parma Pro Panther and TRC Pro 10. You might

also think of the Associated RC10, Kyosho Ultima and Tamiya* Hornet as off-road cars that can be converted to run on-road.

One word in that paragraph might have jumped out at you. Did he say *Hornet* and *on-road* in the same sentence? You bet he did! You see, before I got into the high-tech world of the RC10, $1/10$ - and $1/12$ -scale on-road cars and the like, I started out with a Hornet. In this article, I'll show you how to widen the front and rear ends of the Hornet and lower the center of gravity. You may not win any major championships by making these changes, but you'll have an economical way of getting some *serious* racing out of a great entry-level car! Don't throw anything away: Nothing you'll do to the Hornet is permanent, so you can easily switch it back to race off-road.

For the front end, you'll need: Grasshopper II front A-arms (A-parts) and steering rods (metal parts bag); two 3x27mm bolts and two 3mm lock-nuts (Falcon or Lunch Box screw bag A);



With low-profile foam slicks and little ground clearance, you can easily tell that this isn't a stock Hornet.



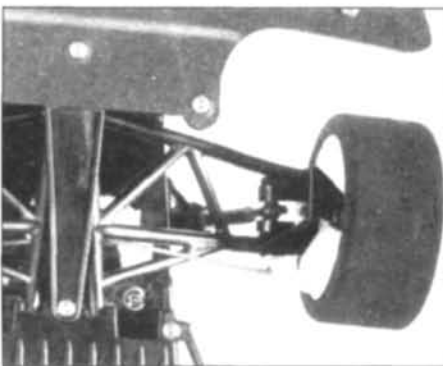
Ready for flat-track racing, the Hornet carries the Chattanooga Chew logo on MRP's ASA Camaro body.

Parma* Heavy Duty Rod Ends and Bolts (No. 12803); Parma Front Bumper (No. 13211); blue compound AJ's* or TRC* BBS front tires; and BoLINK* Tamiya ball-bearings.

First, remove the front A-arms, steering blocks, tie rods, tires, shocks and bumper. Remove the steering blocks and pins from the A-arms and put them aside. They're the only things you'll need from the stock front end.

Install the Grasshopper II front A-arms upside-down, the left one on the right side, and right one on the left side. Re-install the brace to hold the A-arms in place. By reversing the arms, they'll curve up instead of down, thus lowering the front end considerably. These new A-arms are wider than the standard Hornet and Grasshopper A-arms, and will make the front end more stable. Next, re-install the steering blocks and pins in the A-arms, so that the ball joints are facing down. Thread the stock rod ends onto the longer steering rods. With the bottom of the chassis facing up, feed the shorter steering rod

through the long triangle section at the bottom of the right A-arm. Slide the bent end back into the servo-saver and pop the plastic rod end onto the ball-joint on the



Notice that the tie rod is fed through the underside of the new, longer Grasshopper II A-arms.

steering block. Do the same to the left side.

The next step is to replace the front springs with Parma Heavy Duty Rod Ends and Bolts Kit. First, drill a hole through

the back of shock mount on the A-arm using a 1/8 drill bit. There is only a pre-drilled hole on the front side. Take one rod end and line it up in the shock mount and slide the 3x27mm bolt through the mount and the rod end, securing the bolt to the back side of the mount with a 3mm lock-nut. Now, slip a 4-40 Allen screw through the shock mount on the chassis and thread a 4-40 nut from the other side, but don't tighten it yet. Finally, thread the screw into the rod end. Follow the same procedure for the left side. Now, put flanged bearings in each side of the BBS wheels and slide the wheels onto the front axles and tighten the nuts until they're snug against the bearings, then loosen the nuts until the wheels spin freely. Repeat the process for the other side. The new front end measures 8.5 inches instead of 6.8125 inches!

This assembly takes the place of the front spring suspension, and it will allow you to adjust the ride height and camber of the front end. To do this, place the car on a flat surface and adjust the 4-40 screws until the tires stand almost straight



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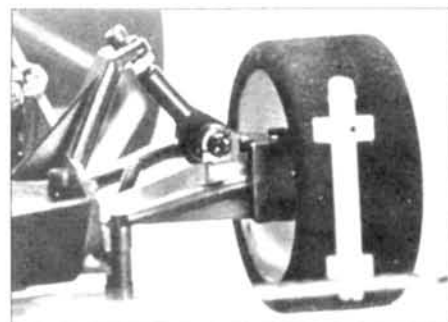
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HIGHWAY HORNET

up and down. I advise having a little positive camber (the tops of the tires pointing toward each other slightly), which will give very responsive steering. This is something you can play around with at the track.

I used Parma's Hornet/Grasshopper front bumper on the Hornet. Put the bumper in a vise and flatten it with a pair of pliers. The new angle of the bumper makes is perfect for mounting full bodies. Simply drill a couple of holes in the bumper to attach your favorite type of body post.

Next we move to the rear of your Hornet, and for this you'll need: TRC or AJ's BBS rear wheels with green compound tires; TRC or Trackmaster on-road/RC10



A 4-40 screw, nut and Parma rod end replace the standard front coil-spring suspension for a rigid, but adjustable, front end.

wheel adapters; four MRC plastic bushings and two washers; and a 1/2-inch of silicon tubing.

Remove the wheels, tires and plastic hubs that are on the car and save them for the dirt. Remove the shocks and disassemble them. Cut the silicon tubing in half and slip one piece onto each shock piston (inside the shock). Refill the shocks with oil and reassemble them. The tubing will limit the ride height by preventing the shocks from extending to their full length. It will still allow for some suspension travel. (Without travel, the traction from the big, 2-inch-wide tires would create tremendous wheel hop.)

As this point, you'll have to modify the on-road RC10 wheel adapters. Using a 3/16-inch drill bit, enlarge the center hole in the adapter so it will fit onto the Hornet rear axle. For safety (and to make a straight hole), I recommend placing the adapter in a vise to keep it in place. If you try to hold the adapter in your hand while drilling, you may hurt yourself or dam-

(Continued on page 134)

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NI-CDS

(Continued from page 94)

and are temperature-dependent. At higher temperatures, the chemical reactions happen at a faster rate, and oxygen is generated sooner, so causing the remainder of the unconverted material to take longer to convert. Since both of these (oxygen generation and material conversion) consume

energy, the sooner you generate oxygen, the less energy is available for material conversion. The bottom line is that *you don't reach as high a state of charge.*

How does all this apply to you?

The average person who wants to compete, but has to pay his own way: What does all this mean to him? Competition is the driving force behind any "action" hobby, but it has the potential to destroy

it when money becomes a restricting, but driving, factor. What can the modeler do? Take control of your organizations, and decide what the objectives of the hobby should be: To build the best car? To develop superior driving skills? If the whole object is to find out who can match batteries best, you can determine that a lot better than by watching a variety of cars

(Continued on page 110)

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Both standard profile (shown) and low profile wheels are available for the RC10.

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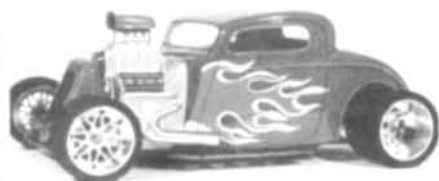
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For more information, contact McAllister Racing, 2205 First St., Unit 107, Simi Valley, CA 93065.



MRC SUPER SABRE Q.D.

Ready-to-run R/C buggies have been given a new name in quality: the Super Sabre Q.D. car by Tamiya. You no longer have to settle for second best when you buy this new 1/14-scale off-road racer, because it's loaded with the superior features and performance that were once found only in cars that you built yourself. Each Super Sabre Q.D. (Quick Drive) comes with a radio system installed in the chassis and a pistol-grip transmitter that permits fully proportional left and right turns. An electronic speed control is used for quick throttle response and durability. Six frequencies are available, so more of your friends can join in the fun provided by these outstanding cars.

For more information, contact Model Rectifier Corporation, P.O. Box 267, Edison, NJ 08818.



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The new Sprinter series from Pro-Line is the ultimate improvement in dirt-oval racing. This series of front pin-spike tires fits Pro-Line Nos. 2524, 2525 and other 1.7 wheels. The Sprinter ovals come in both left-directional (Pro-Line No. 1038) and right-directional (Pro-Line 1039) pin-spike tread patterns. The Sprinter Vee (Pro-Line No. 1037) has a V-pattern pin spike tread designed to be used in tandem with its sister ovals, or alone. The Sprinter series will give you increased control and speed on almost any dirt-oval course.

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For more information, contact Tekin Electronics, 970 Negocio, San Clemente, CA 92672.

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TEAM LOSI TURNBUCKLE LINKS

With the Turnbuckle adjustable links, it's easy to make the fine suspension adjustments necessary for a winning performance. The new A-1009 unit is 1 1/2 inches long and can be used for steering links or upper control links on the JR-X2, the RC10, the Optima, etc. The A-2005 unit is 1 1/8 inches long and is ideal for rear links or applications where a shorter link is needed. The 4-40 thread fits most popular ball links. The No. 6001 heavy-duty balls and ball cups are shown. All items are available separately.

For more information, contact Team Losi Inc., 1655 Mission Blvd., Pomona, CA 91766.



BUD'S MINI BI-LEVEL WING

This new mini wing follows the very popular larger version, the Bi-Level Super Wing. The Mini Bi-Level Wing produces slightly less drag and downforce, and it weighs less than the larger wing for today's superfast 1/10- and 1/12-scale on-road cars and 1/10-scale off-road cars. During the R/C Hobbies Peach Bowl Classic in Atlanta, GA, a car using the new Bud's Mini Bi-Level Wing broke the track record by six laps on the high-banked oval!

For more information, contact Bud's Racing Products, P.O. Box 601, Amherst, OH 44001-0601.



CRAIG MODEL CO. 1/10-SCALE HEMI

Craig Model Company's newest release for 1989 is the 1/10-scale Hemi. Modeled from clear .040 Lexan, it requires paint and trimming. It has a 6-71 GM-style blower, a modified Model-T grill shell, a fuel tank and a small front spoiler to cover that drag chassis. The air scoop is either included, or can be purchased separately. The hemi's many uses include: altered-class drag cars, a more scale appearance for funny cars, street rods, or wild-looking modified sled pullers with up to 6 engines.

For more information, contact Craig Model Co., 19515 FM 149, Box 142, Houston, TX 77070.



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NI-CDS

(Continued from page 106)

driven by drivers of various skill levels run around a track. Just charge your matched packs and then see who can keep a 6V 60-watt bulb lit the longest. Not very exciting? How about the race sponsors providing the packs on a random-draw basis? How about a "claim" race? For \$29, any pack may be claimed from another racer immediately *after* the race! Controversial? Sure; but isn't it worth it to give an exciting hobby an extension on life as it retains competitive drivers who will no longer be forced into bankruptcy.

Editor's Note: C.L. Scholefield, the author of this article, is the Manager of Technical Marketing at Gates Energy Products.

DIRT DIGEST

(Continued from page 30)

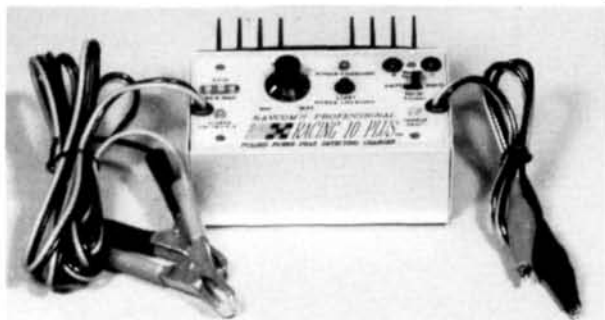
able motor mount).

I admit that his hyper Frog was quick. Although endowed with some oversteer, the Frog buzzed around a regulation-size softball infield in only two-thirds the time it took a stock Optima Mid. (Keep in mind, though, that the price tag on a Frog,

(Continued on page 114)

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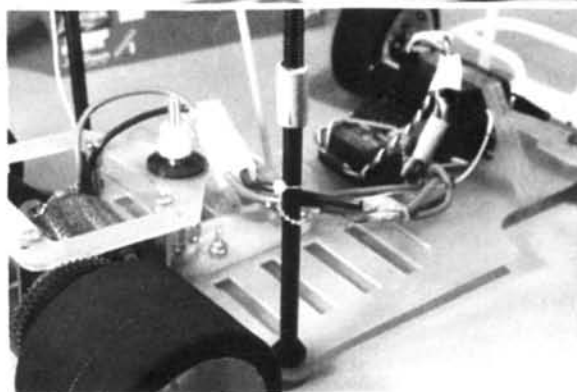
BY ERIC GOLDSCHRAFE

MY GARAGE IS starting to get crowded, as I maintain several cars for weekly racing and evaluation. I've discovered a lot of useful data on just about every 1/10-scale on-road car in production and a few that aren't. I'll eventually present these results in a format that should help you decide which car is the best choice for you. Staying with this column will help you set up and race these cars, and I'll also keep you informed about any changes, modifications and improvements.

To do all this, I've acquired the dedicated support of fellow contributors Joe Bruni and Rudy Meyer, and also some extra driving talents, including Jeremy and Patrick Meyer, Phil "the Rebel" Cantrell and Joe Cipriano (an R/C buff who drives and maintains full-scale NASCAR stockers and modifieds). With Phil's diversified and successful racing interests and some neat tricks used on Joe's full-size race cars, we've come up with a pack of fairly competitive cars.

One of the first things we do to make any car more competitive is add a front bumper if the kit didn't include one. "A bumper will make my car more competitive?" you

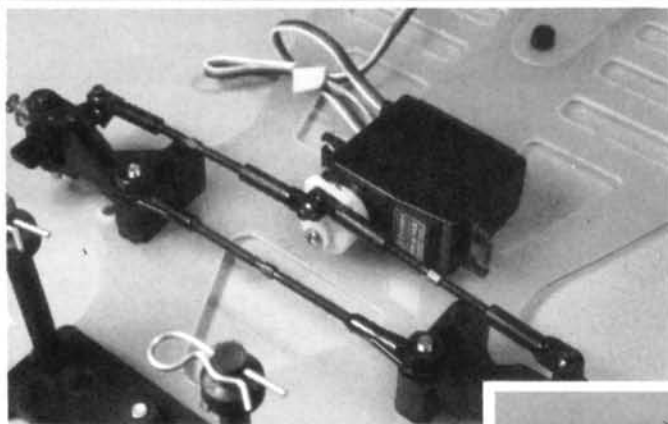
ask. Well, to win races, you have to keep moving as fast as you can, and even if you're an expert driver, somebody can knock you into the wall. Without a bumper, the car tends to stay on the wall, and without reverse, you're at the mercy of the corner marshals. On impact, the body also flexes over the front wheels, and this will eventually result in cracks that allow the front of the body to bounce around and drag on the ground. This not only causes the car to slow or go out of control, but at many tracks will also earn you the black flag. With a front bumper, the car will bounce off the wall, and you should be able to point it in the right direction and get back on the throttle without losing too much time. If you use a bumper that fits the contours of the inside of the front of your body and install it so that there's a close fit, it will prevent the body from flexing in a crash. This will increase the longevity of the body and your paint job, and it will even stabilize the body on the mounting posts somewhat.



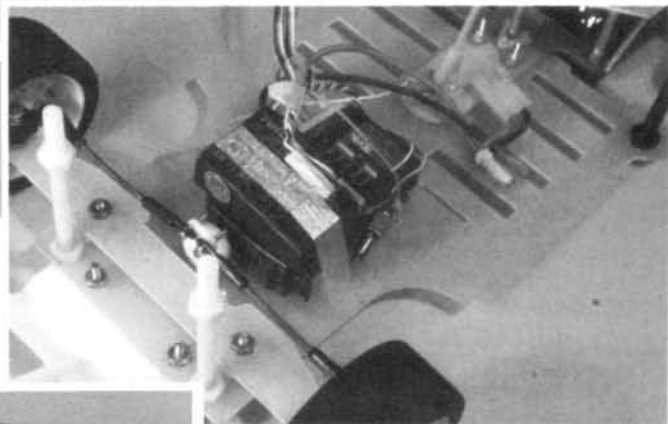
This photo shows how the wiring from the motor to the speed control is attached to a body post with a tie-wrap, which prevents it from sliding out of the protective chassis.

There are several brands of front bumpers available, but Pro-Line* manufactures such a good selection that we've found one that fits every chassis and every body we've come across. You might have to drill a couple of holes, or trim away some of the mounting surface, but the material used by Pro-Line is easy to work with, and you can dye it any color you wish.

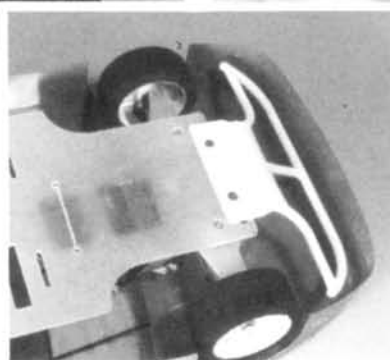
Right at the start, we also tie everything down *securely*, especially the wiring. If your radio or battery wires can fall out and drag on the ground, you're looking for a DNF before you even enter a race. About 90 percent of DNF problems are simple electrical failures—mostly broken wires. We figured that if cars are whizzing around Island Raceway (Hauppauge, NY), turn-



Replacing inadequate front-end parts with quality pieces, such as the heavy-duty steering linkage shown here (available from several manufacturers), will do a lot to make your car track accurately. Note center pivot-point hook-up on servo to reduce deflection during servo travel.



Here, the receiver is attached to the steering servo with Velcro to allow easy switching from car to car, but strapping tape has been added for insurance. The speed control also mounts to the chassis with Velcro, but a plastic tie-wrap makes sure it stays there.



Any car can benefit from the addition of a front bumper. Note how this Pro-Line bumper fits into the front end of the body, providing both protection and stability.

ing 36 laps in 4 minutes on the 200-foot track, the average speed is in the neighborhood of 25mph. At this speed, the sudden deceleration when hitting the wall or a dead car subjects the car to an incredible G-force, and if anything *can* come loose, it *will*. If your wires flop around in the car, one of them will eventually break, and then you're out of the race. This will really ruin your day, especially if you're leading the A-Main at the time!

Solder joints give a lot of trouble, because as the wire flexes, the strands fracture where the solder has stiffened them, and when a few strands have broken, the rest let go at an increasing rate. If you look at the joints, you'll see this happening. When you're down to just a couple of strands, even a minor jolt can snap them. If it's a battery lead, the current-carrying capacity will also be severely restricted, so causing a performance loss, too. When soldering, do a proper job, and check these joints frequently. Sometimes the wire's insulation hides a problem; look for kinked or unusually flexible areas in the wiring, and replace suspect areas. In an emergency, splices are OK, but try to avoid these in permanent wiring, as they're potential trouble areas, particularly when they involve R/C connections. Tie-wraps or tape will hold wiring securely, and any unsecured wiring, such as the lead wires on a Ni-Cd pack, should be only long enough to do the job without straining. In a long race, or a tough one, it's a good idea to tape down the battery wires temporarily. We have some other things that will help here, but I'll go into these at another time.

The remaining 10 percent of the problems that cause DNFs are mechanical, and

the most common of these involves front-end damage. Broken steering blocks, lost wheels, and steering linkage maladies are the most often encountered, and the aforementioned front bumper will do a *lot* to prevent damage to this area. Having the driving skill to *avoid* accidents will also help, even if you have to slow down to see where cars spinning in front of you will wind up. Better to be safe than sorry! When you replace worn parts in your front-end assembly, save the old ones if they're useable, because if your car gets busted in a heat race, these "spare" parts might keep you from becoming a "scratch" in the Main.

Most racers seem to have a knack for setting up the drive gears, but they still have trouble with these parts during racing. Our statistics show that cars equipped with Delrin or nylon-type plastic rear axle/motor mounts had more problems in this area than cars using metal mounting blocks, so we did a little research into the problem. It seems that the heat generated by the motor during racing causes the plastic parts to become softer and more slippery, and this allows the motor to move around during a severe impact. This movement (even just a little) will affect the backlash setting that you've so carefully dialed-in, particularly with 48- and 64-pitch gears. Torquing-in the motor-mounting screws extra tightly

might not help, and it's definitely possible to strip out the thread in the motor holes while doing it. Leaving the gears out of proper mesh in a high-performance car will result in rapid gear destruction, so causing a loss in efficiency and an increased racing budget. A common star washer (the ones with the "teeth" around the outer edge) between the head of the motor adjusting screw and the mount should keep the screw from sliding in the slot, because the serrations grab the plastic.

Have you noticed that your car doesn't handle the way it used to? Perhaps you've gone through the entire front-end setup and, although perfect, the car still seems to wander on the track. Check the mounting screws holding the "T" plate to the chassis; we had a couple of different cars develop sloppy fit or bolt shearing, and a visual inspection never revealed it. Try wiggling the rear end from side to side; if there's any play, you must find out what's causing this and fix it. A car with 4WS is neat to drive, but not if you can't control its direction!

While they must remain stock in "stock"-class racing, motors still have to be maintained. Those who run fastest at our track clean and prep their motors after *every* heat and also check them carefully. Even if the motor was run for only a few minutes, when you remove the brush springs and pull out the brushes, you'll see a lot of crud on the curved portion of the brushes and the commutator. A cotton-tipped swab soaked in motor spray cleaner will remove this build-up easily, and stubborn deposits can be removed with a pencil eraser. Carefully reassemble the brushes, put them back in the same way that they came out,

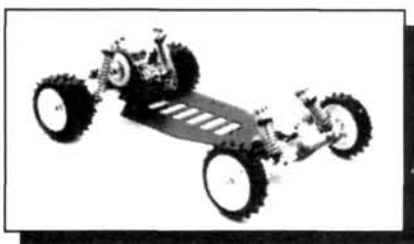
(Continued on page 154)

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DIRT DIGEST

(Continued from page 110)

with all its options, is nearly twice that of a Mid.) Then he decided to put a wing on the Chenoweth body, because "all the professional cars have one." Besides, a wing should reduce the oversteer problem. On the next pass around the bases, his winged Frog rounded first at full throttle and flipped over in one of the most graceful series of end-over-end cartwheels I'd ever seen, and the wing was ripped off in the process.

Devoid of the wing, the Frog was sent around the bases again to duplicate the stunt, but it couldn't. It held the track as it had originally. It was more stable *without* the wing than with it. Or, rather, it was more stable without a wing than it was with the wing positioned the way he had installed it.

To solve the problem, we turned to a hair dryer, some rubber cement and white thread. We put small globs of cement on the body along the hood and the top of the cockpit and stuck strands of thread in the glue. When it dried, we turned the hair dryer on the beast at full force (*cold setting!*) and watched the thread move.

It's the same general principle as a wind

(Continued on page 120)

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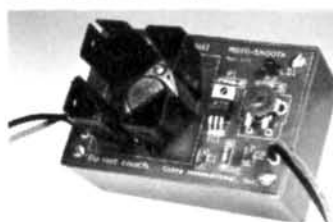
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SECOND LOOK SERIES

KYOSHO

OPTIMA

**Faster than a speeding bullet—
Able to leap the roughest terrain in a single bound—
The Optima has it all!**



THE KYOSHO LINE of R/C kits, distributed by Great Planes Model Distributors*, includes everything from planes to cars and boats. Their car line has something to suit everyone's taste from the four-wheel-drive .21 gas-powered Integra Vanning to the

four-wheel-drive electric off-road Optima. The Optima was designed to be competitive on the racing circuit straight out of the box, but with the addition of the optional ball bearing kit and a hopped-up motor, championship performance can be expected.

THE KIT. The Optima comes attractively packaged



A



photos by Louis DeFrancesco, Jr.

in a large box covered with many full-color pictures of the car from various angles. All parts are well packed to prevent damage during shipping. The 31-page assembly manual is very complete and it contains all the information needed to build the car and much more. It has a table which explains the pros and cons of each of the different Kyosho chargers, it tells about the optional Kyosho LeMans motors, and it gives a good description of the recommended front and rear end adjustments. The radio installation section of the manual contains specific installation instructions by manufacturer and servo model for the most commonly used radios.

CONSTRUCTION. The assembly of the Optima is organized into 44 nicely illustrated steps which are explained in the manual. There is no need for me to comment about specific assembly steps, because the building instructions are so good and all parts fit very well.

The Optima's main chassis consists of eight aluminum pieces. These parts bolt together to form cages in the front and rear which enclose the gear boxes and are connected by two aluminum bars. The gear boxes are molded of fiber-filled nylon and house the differential in the front and the differential and some of the drive gears in the rear. The differential housings are also made of fiber-filled nylon and contain metal gears. Each differential is supported by two ball bearings. Power is transmitted to the front differential by a fully enclosed chain-drive system, which works well and is not subject to the wear that would occur with an open system. Two different differential gear ratios are provided so that the builder can vary the relative speeds of the front and rear wheels. I set up my car so that the front and rear wheels rotate at the same rate.

The front and rear suspension systems are constructed largely of fiber-filled nylon for strength and lightness. Both consist of extra-long double wishbones for handling uneven terrain with minimal effects on steering. Dampening is provided by coil-over oil-filled shocks on all four wheels. Both the front and rear suspensions have adjustable camber and ground clearance. Each of the front and rear axles are supported by two plastic bushings. Kyosho offers ball bearings as an option. The four tires are of a spiked design similar to those on most R/C off-road cars.

The radio control is mounted on a fiberglass plate, which also serves to stiffen the main chassis and hold the motor battery. Parts are provided to mount just about any of the common standard or mini servos. The resistor type speed controller provides three forward, one braking, and two reverse speeds. The controller also has a voltage step-down circuit so that the radio control can run

by DAVID TROST, M.D.

KYOSHO

OPTIMA

Type 4WD buggy
Scale 1/10
Sug. Retail Price \$239.95

DIMENSIONS:

Overall Length 15³/₄ inches
Width 9¹/₂ inches
Wheelbase 10⁵/₈ inches
Front Track 9¹/₄ inches
Rear Track 9³/₈ inches

WEIGHT:

Gross (w/bat.) 3 pounds,
10 ounces

BODY:

Type Off-road buggy
Material Lexan

CHASSIS:

Type Aluminum ladder-rail
Material Aluminum

DRIVE TRAIN:

Type (pri./sec.) Pinion-spur/chain
Differential Planetary gear
Bushings Type Plastic

SUSPENSION:

Type (f/r) A-arm
Dampening (f/r) Coil-over shocks

WHEELS:

Type (f/r) One-piece plastic
Dimensions (f/r) (DxW) 2x1.25
inches

TIRES:

Front Pin-spoke
Rear Pin-spoke

ELECTRICS:

Motor RS-54OS
Battery Required 7.2V to 8.4V
Speed Controller Mechanical 3-step

OPTIONS AS TESTED:

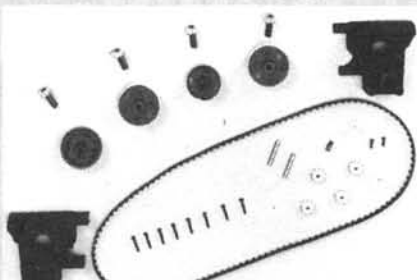
JR Circus 4-channel radio, LeMans 480G motor.

COMMENTS:

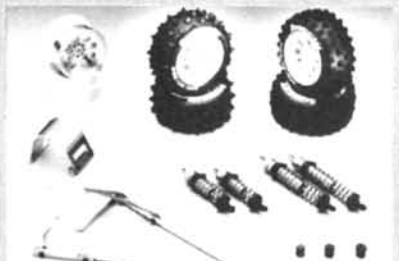
A solid performer and the first of a very successful line. The 3-step speed control was a major weak spot. Unfortunately, the original rear-engine Optima series is no longer being produced, but some deals should be available on the remaining cars in stock.

SECOND-LOOK SERIES BUYER'S GUIDE

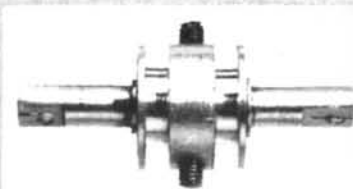
An impressive flood of after-market parts has followed the great success of the Kyosho Optima and many of these parts may be used to address the inherent weaknesses of this off-roader. Whether you need tires, suspension components, drive-train accessories or bodies, your choices seem endless. Here are some of the parts you might want to consider.



The Kyosho Belt-Drive kit includes everything you need to convert your Optima to belt drive. The belt conversion has a steel-reinforced belt and new differentials with metal bevel gears. You can even buy optional ball differentials for optimum performance.



From heavy-duty Gold and Platinum shocks to lightweight wheels for low-profile tires, the Kyosho Option House accessories can meet the needs of your Optima.



Parma's positive-lock differential replaces the original bevel gears (eliminating a breakage point) and uses one-way clutch bearings to give more positive steering response.



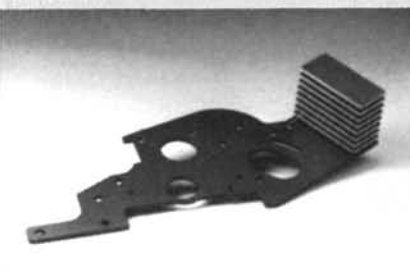
Tecnacraft offers Show and Go quality aluminum wheels for the Optima. These wheels don't require special adapters or hubs, and they accept stock tires without glue.



The addition of ball bearings, e.g., the DuraTrax pictured here, should be the first step in hopping-up your Optima. You can make your car go faster and run longer with stainless-steel bearings that are built to last.



The RCRC quick-disconnect battery holder eliminates the usual struggle with time-consuming tie-wraps that always get lost or break.



With more than 15 square inches of heat-exchange surface area, the Litesink motor mount lowers motor-operating temperatures.



The aerodynamic shape of Dahm's racing body slices through the air while creating enough downforce to help hold your car on the track at high speeds. The Warrior is designed to fit the Optima with no modifications.

OPTIMA UPDATE

WE FEATURED the Kyosho* Optima in the Spring '86 issue of *Radio Control Car Action*, so it's now time to take another look at this 4WD off-roader. What has happened to it during the last three years? Since its introduction, the Optima has gained acceptance as the standard against which other off-road vehicles can be measured. It quickly dominated every racing event in which it made an appearance, but, as usual, innovative racers couldn't wait to improve the original design in an attempt to make their winning edge as wide as possible.

Optimizing the Optima

Racers wanted to upgrade the Optima's handling: They found that the dampening could be improved by adding a heavier set of shocks and that traction could be greatly improved by using a lower-profile tire that would eliminate excessive chassis roll in the corners.

These improvements were quickly copied by Kyosho and incorporated in its Turbo Optima, which then provided consumers with these upgrades as part of the standard Turbo kit. But where did that leave the thousands of original Optima owners? Kyosho rewarded them with an innovative after-market parts line called Option House. After that, all the improvements that had been made to the Turbo Optima could be added to the standard Optima—right down to the 16 precision ball bearings and the rich-looking gold chassis components.

As the Optima persistently outperformed the rest in its class, other manufacturers soon followed Kyosho with an array of after-market components that ensure the big O's continued success. Hot Trick Racing* introduced the TriDirComp chassis to help the Optima lose some weight; Trinity* introduced

a graphite chassis. To provide better control when cornering, the differentials have been made more efficient with one-way bearing systems for the front gearbox, and the standard gear differentials can be replaced with ball differentials. The Optima's basic drive system is a chain that drives the front and rear differentials. Many thought that this was a problem because it could stretch and break, and consumer demand for a belt-drive system soon led to its introduction.

Almost before we realized what was happening, the Optima started showing up on ovals as well as on off-road circuits, and within a relatively short time, oval conversions were available from just about every R/C manufacturer.

Next, the Optima showed up as a heavy-metal contender—a hot, off-road truck—and, sure enough, the after-market conversions followed with kits for racing or just for monster-truck fun. On the subject of conversions: Some innovative companies even started making it possible for you to mount the Optima's engines amidship. As you all know by now, Kyosho has taken this idea seriously, and it's now available through the family of Optima Mids. Once again, the after-market suppliers are in hot pursuit!

Overall, the Optima's performance has proven to be more flexible than Kyosho probably ever expected it to be. With appropriate after-market support, it has shown its adaptability to almost any type of racing, and Kyosho has even made it possible for you to acquire a version that suits you best.

The Optima's record speaks for itself and makes a clear winning statement on most tracks.

**Here are the addresses of the companies mentioned in this article:*

Kyosho; distributed by Great Planes Model Distributors, P.O. Box 4021, Champaign, IL 61820.

Hot Trick Racing Cars, Inc., 1157 Cushman Ave., San Diego, CA 92110.

Trinity, 1901 E. Linden Ave., #20, Linden, NJ 07036.

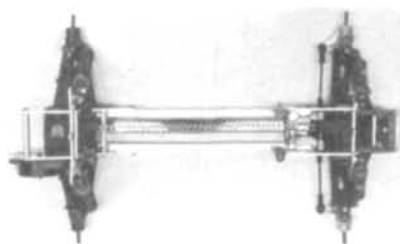
the 7.2V motor battery. I used a JR Circus* Hobbies 4-channel radio with two NES-505 servos.

The motor and battery used for this review were the LeMans 480G and the Kyosho* 6-cell, 1200mAh racing battery. The Optima comes with an RS 540 motor, but I wanted to take advantage of one of the other available powerplants.

The Kyosho LeMans motors are modified, high-performance motors, and six are available. The LeMans model numbers are based on the motor's expected run time (in seconds) using a 6-cell, 1200mAh battery pack. All the LeMans-series motors have adjustable timing, diamond-trued commutators and all (except the 600E) have dual ball bearings. The 480G also features a machined-aluminum end bell for durability.

The car is completed by trimming the clear polycarbonate body and driver/radio cover along the lines marked and finish-

ing them on the inside with paint. A nice set of pressure-sensitive decals was provided for the outside, and I used the Tamiya* paint that's specially formulated for polycarbonate bodies.



The main frame of the Optima, Turbo Optima, Salute and Javelin has served many a racer well by bringing home the gold. We're sorry to see that it's being phased out.

A Kyosho Auto Charger was used to get the most out of the battery. This charger operates off a 12V car battery and will charge any 4- to 6-cell, 100 to 4000mAh Ni-Cd battery safely and auto-

matically. You simply hook it up, press a button, set the desired charging current from 0 to 4 amp hours and let the charger do the rest. The built-in ammeter and voltmeter allow constant visual monitoring of charge status. The charger has a delta peak automatic cutoff to ensure safe charges to 100-percent capacity. This charger was very easy to use; it consistently recharged the car battery from dead to full capacity in about 18 minutes.

PERFORMANCE: Running the Optima is when the *real* fun begins. The car comes with two pinion gears (12 teeth and 15 teeth) to vary the car's speed/torque ratio. To get the highest possible speed, I used the 15-tooth gear almost exclusively, and I also advanced the motor timing by 4 degrees. The LeMans 480G motor accelerates the car quickly and gives it a very fast top end. The suspension easily handles rugged terrain and can absorb a

(Continued on page 154)

DIRT DIGEST

(Continued from page 114)

tunnel, but not as accurate. However, using the thread pattern to see where the air was flowing across the top of the body, we were able to better position the wing to do the job it was intended to, i.e., to keep the rear down and eliminate the oversteer. (Rubber cement will rub off the polycarbonate surface, so there's no permanent damage.) Whether you have a Frog, an RC10, an Optima, an Ultima or a Cat—or any of the plethora of currently available cars—the same technique works. A wing isn't like a hat: It isn't there just because it looks good.

We've finished already, and we haven't had time to show you a bald Burns spur gear as we'd planned. Look for it next month with some more reader mail. For now, we're going to dust ourselves off. ■

BUDGET RACER

(Continued from page 65)

the rear bounced too much. This combination made steering dicey and prevented

me from using lots of throttle coming out of turns.

On a track with good traction—and this soft, clay track has good traction—if you have to feather your throttle coming out of any but the sharpest turns, your car isn't set up correctly. Incidentally, coming off the corners is a good place to pass a car that has traction problems. While they're sliding around, you're *gone*!

Raider Ransack

- To see if the suspension would bounce less, I changed the damper oil from 20W to 10W. This helped, but not enough.
- The pre-load on the rear springs was reduced by moving the adjusters 3mm, and the adjusters on the fronts were backed off to the limit. Now the handling was getting into the ballpark, but the front end was still chattering too much on the choppy stuff.
- I had a set of Associated* silver front springs for my RC10 with me, so I installed them on the front end of the Raider. I eventually settled on 8mm of pre-load, since the RC10 springs aren't as stiff as the Raider stock ones.

With this setup, the front end settled

down and handled perfectly; but there was still too much bounce in the rear.

• The pre-load was reduced all the way, but instead of improving the handling, it made it worse. On the big bumps, the suspension was now hitting the stops, and the car was doing endos! Back to the drawing board!

• The 3mm pre-load setting was a compromise. The handling that resulted is about as good as I could get with these shocks and the stock rear tires, but it's still a long way from perfect. Recently, however, it was good enough to earn me the top qualifier spot in Production Class and a 4th-place finish in the Main at Sacramento Mini-Wheels.

The Raider is capable of being improved a lot more. Here's the direction we'll go in the next installment of "Budget Racer." We'll install a set of Tamiya plastic shocks at the rear, along with new rims and low-profile tires. We might even wind some special springs. In addition, Kyosho has a new stock motor that will give the Raider a bit more suds, and we'll try some different gear ratios to get the maximum "coming-out-of-the-turns" acceleration.

Oh yeah, we'll also go *oval racing*.

(Continued on page 124)

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This professionally produced, full-color 35 minute videotape takes you from the box to the starting line with great action footage and the answers to many questions you may have about R/C cars and trucks. The R/C Car Companion guides you step-by-step through the assembly and set up of R/C's Entry-Level Car of the Year: the Kyosho Raider. Discover how to select the best model for your level of interest, which tools you need for assembly, and how to paint your car to achieve a raceway finish. You even learn driving and performance hints from R/C car experts such as Bill Fries and "Crazy Chris" Chianelli. These voices of experience let you in on the tips that can make your machine the "baddest in the land" — secrets that might take years to find out if you were on your own!

So if the difference between a dogbone and a shinbone has you flustered, don't worry — you can always rely on the R/C Car Companion from Milt Video to set you straight. It's the R/C pit crew that's ready to get you started in R/C buggies the fun and easy way. Test-view the R/C Car Companion at your favorite R/C car dealer today! Available in VHS or Beta.

The R/C Car Companion

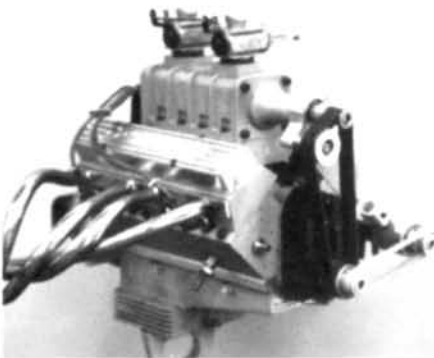


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Optional items:

Supercharger Intake Manifold (nonfunctioning), including pulleys and belt \$49.95

Ball Bearings (11 required) \$108.00

Blueprints (Will be credited toward engine purchase; engine cannot be made from blueprints alone.) \$40.00

Illinois residents add 6 1/2% sales tax. Make checks (money order, cashier's or certified checks) payable to:

**Conley Precision Engines, Inc., 820 Ridge Ave., Suite G
Lombard, IL 60148 (312) 953-8882**

BUDGET RACER

(Continued from page 120)

Winning Raider

I promised you an inside look at Scott Hightower's Production Class winning Raider, so here are the specs for Scott's car:

- Front tires: Associated spikes.
- Rear tires: MRPs on low-profile rims.
- Front shocks: Kyosho's Mini-Golds with the stock springs.
- Rear shocks: a set of Yokomo C-4 front shocks that were donated by a friend.
- A Twister Super Stock motor turns a 15-tooth pinion.

That's it, except for expert driving and usual maintenance. It might be different where you live, but Production Class here is all RC10s, JR-X2s and Ultimas, so this Raider is keeping—and beating—some pretty fast company.

See you at the track!

**Here are the addresses of the companies mentioned in this article:*

Kyosho; distributed by Great Planes Model Distributors, P.O. Box 4021, Champaign, IL 61820.

Pro-Line USA, P.O. Box 456, Beaumont, CA 92223.

Associated Electrics, 3585 Cadillac Ave., Costa Mesa, CA 92626.

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AGITATOR

(Continued from page 71)

Overall, the Agitator appears to be a winner. Apart from a few problems, assembly was a snap, and this slightly heavy car's easy assembly and rugged construction will make it popular and a great racer.

**Here are the names of the companies mentioned in this article:*

Advanced Racing Technologies, 460 Cypress Lane, Suite F, El Cajon, CA 92020.

BoLINK R/C Cars, Inc., 420 Hosea Rd., Lawrenceville, GA 30245.

Litespeed, P.O. Box 4765, Spokane, WA 99202.

Dan's RC Stuff, 9525C Cozycoft Ave., Chatsworth, CA 91311.

Paragon Racing Products, 8802 Knollwood Dr., Eden Prairie, MN 55344.

Futaba Industries, 555 W. Victoria St., Compton, CA 90220.

Novak Electronics, Inc., 128-C E. Dyer Rd., Santa Ana, CA 92707.

Checkpoint Racing, Inc., 729 W. 16th St., #B4, Costa Mesa, CA 92627.

Trinity, 1901 E. Linden Ave., #20, Linden, NJ 07036.

Robinson Racing Products, 501 Peach, Santa Ana, CA 92704.

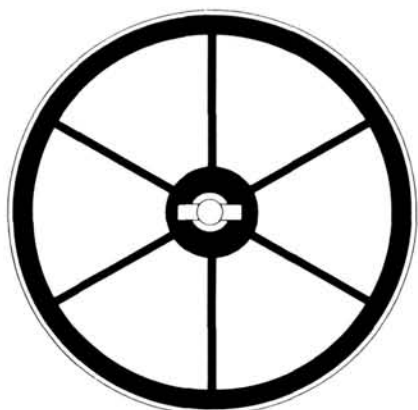
TRC, P.O. Box 1058, 2211 Charter St., Albemarle, NC 28001.

Associated Electrics, 3585 Cadillac Ave., Costa Mesa, CA 92626.

Parma International Inc., 13927 Progress Pkwy., North Royalton, OH 44133.

Bud's Racing Products, P.O. Box 601, Amherst, OH 44001.

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PINK	5053-P	5054-P	5052-P	5051-P	5050-P
YELLOW	5053-Y	5054-Y	5052-Y	5051-Y	5050-Y
BLUE	5053-B	5054-B	5052-B	5051-B	5050-B
GREEN	5053-G	5054-G	5052-G	5051-G	5050-G

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POLE POSITION

(Continued from page 128)

equipment. They come to the races prepared. They practice, practice, practice. At a major event where stock motors are handed out, why do most of the same drivers make the A-Main in both Stock and Modified? They drive their way there. Today's stock motors can't be tampered with, and if you try it, you'll damage them. You can change brushes and springs to improve performance. This is very tedious work, but it will make a difference, and that's how they beat you—through tedious, time-consuming, hard work. That's what it takes to win.

What about a solution? Should ROAR create a rule that would require stock-motor manufacturers to incorporate a standard degree of timing advance? Are you prepared to go more slowly? Are you prepared to watch the same drivers win? What about the motors that are now available? Should we make everything you now own illegal? Should we make everything currently on the hobby dealers' shelves illegal? How do we explain to a foreign manufacturer that his motors, ordered six months ago, won't be ROAR-legal when they arrive here in the United States? There are about 10 importers of ROAR-

legal stock motors, each importing several thousand motors a month. If we gave them six months to comply with a standard timing specification, it's conceivable that nearly 500,000 motors would be imported between now and then. What would become of these motors? Do they become illegal? How do you police this? Think about it. Think about the economic ramifications. Can we afford to burden manufacturers with all this obsolescence? Maybe you think these motors would just get used up. If they're left in circulation, anyone who wins a race would be accused of running one of the "old" motors. Sounds like chaos in the making!

How about creating a new class? You heard me—a new class. The class we now call Stock will become Super Stock, or something along those lines. The revised "Stock" class would be based on a new set of motor specifications that would include a fixed standard for timing advance. To encourage longer motor life, this advance would be kept to a minimum. Of course, these motors would have to be tamper-proof, and the commutator would be locked onto the shaft. The longer motor life would obviously mean lower racing costs for enthusiasts. The motor would be the only difference between the

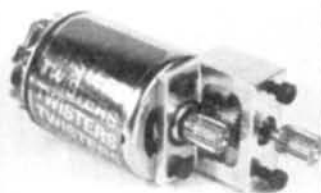
"Stock" and "Super Stock" classes. Local clubs and events would determine their own needs and requirements.

Let's review the benefits of this approach: First, we've accommodated racers who want to race competitively without buying a new motor every week. We've accommodated racers who like to play with their motors to increase performance, without forcing them into the expense of moving up to the Modified Class. We haven't made our equipment obsolete. In fact, we've created another market for manufacturers and suppliers to provide more products. More important, we've devised a solution that allows good competition, not only on the track but also in the industry. Most important, we'll put the fun back into our racing. Isn't that what this is all about?

John Thawley
ROAR Administrator

John's letter offers hope that ROAR will try to solve the stock motor problem in the near future. The Super Stock Class and the Stock Class could co-exist at the local and regional levels. At the Nationals, where the "stock" motors are handed out, only one class would be necessary for

(Continued on page 132)



2 TO 1 TRANNY

Gear Reduction Transmission, Fits Predator, Villan GP10, Shadow 2 + 2, Viper Outlaw, Infinity-ID, VicFor and Others.

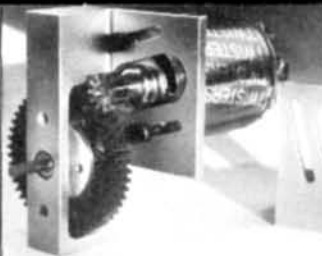
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State Receiver Plug Style When Ordering

POLE POSITION

(Continued from page 131)

27-turn motors. But as John said, watch what the winners do, prepare your car *before* you get to the track, and practice while others work on their cars at the track. Until next time, try to keep it shiny side up! ■

PROJECT BLACKFOOT

(Continued from page 83)

variety, and this gives a much smoother and more consistent operation. This diff will accept the stock dogbone drive assembly as well as Thorp's own dogbone conversion. The dogbone conversion consists of a pair of drive cups that fit the differential and a set of steel dogbones that are similar to those used in the popular RC10. These have a pin through the end of the dogbone and slotted drive cups, and new, steel, drive axles. Used with the Thorp differential, they produce a 100-percent improvement in how the Blackfoot gets the power to the ground. The dogbones allow for smooth operation throughout the entire range of rear-suspension movement. Even at the upper and lower extremes, the rotation of the wheels is as smooth as if they were parallel with

the diff. If your budget allows it, you should invest in the Thorp hardware, as it will cure the problem you had or will have with the stock assembly.

After installing the Thorp differential and counter gear, the diff side plates were bolted into place and the entire assembly attached to the chassis using the aforementioned method. A Revtech* 18-turn motor provided the power for the Blackfoot that was fed by a Tekin* ESC190 speed control. A Futaba 3PG Magnum was used as the guidance system, and the package was finished off with a custom-painted body, aluminum wheels, and a set of low-profile tires. The durable, good-looking TMS* aluminum wheels are just about the sharpest you'll ever find, and they combine well with the TMS low-profile tires (made specially for the Blackfoot). The tires have a range of available tread patterns, from the smaller spikes used on the front to the more aggressive spikes used on the rear. The JG body was molded in the same style as the Blackfoot's, but it's molded of considerably lighter Lexan, and while I'd like to take credit for the sharp-looking paint job, it was also courtesy of JG. With all the new hardware in working order, I headed to the sun and sand of the beaches in La Jolla, CA, with our lead-fingered test pilot, Chris Stump.

PERFORMANCE: As a crowd gath-

ered on the cliff above us, Chris made a couple of warm-up laps around the beach. On the second pass, the throttle position was quite apparent, as the tail of the Blackfoot squatted and the TMS spiked tires aired out some of that California sand. Although sand isn't the ideal terrain when run time is a consideration, with its stock gearing, the Blackfoot was able to turn 4 minutes and then some with strong acceleration and good speed. Getting the Blackfoot around a turn in sand required just a touch of the brake, but the tires were intended to be used in dirt. We were just out having fun, but, seeing the improved performance allowed by the changes, I couldn't wait to get to the track.

Just as I suspected, this hybrid Blackfoot was right at home on the harder-packed dirt. The front tires guided the Blackfoot through the turns faster than ever possible in the stock configuration. Under acceleration, the weight transfer planted the rear wheels as the truck rocketed down the straight. At the end of the straights, a touch of brake would roll the weight onto the front wheels, and this provided bite on the turns. A little roll was evident and the inside front tire would get air, but this rarely resulted in a roll-over.

After running for some time, I discovered that the front shocks needed a lighter weight oil than the rear shocks did. The

(Continued on page 134)

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PROJECT BLACKFOOT

(Continued from page 132)

front suspension has less of a mechanical advantage over the shocks than the trailing-arm rear suspension. This simply means that it's harder for the front suspension than the rear suspension to compress the shocks. I switched to Robinson Racing's 5W synthetic oil, which gave good results. The stock springs were also replaced (or moved) because they limited suspension travel. The front springs for the original Tamiya oil shocks (these are different from those included with the kit) were used on the rear suspension. In their place, a pair of light springs from Kyosho's* Gold shocks were used. With the addition of the large spring spacer on the rear shocks for a little added tension, the suspension had a considerably easier time soaking up bumps, and this markedly improved handling.

To say the least, this modified Blackfoot will be at the head of the pack in competitions, and it will also spend much less time on the disabled list because many of its maintenance problems have been solved. Although it might not hold up against some of the high-tech monster truck conversions for the RC10 or the Ultima, when racing against its own type, it will never be as unpredictable as it once was. I can't claim that the truck will "driv-

itself" once these modifications are made, but getting around the track will be a new experience, and you won't need a toolbox full of stock dogbones to get through the day!

*Here are the addresses of the companies mentioned in this article:

Tamiya/MRC, P.O. Box 267, Edison, NJ 08818.

JG Manufacturing, P.O. Box 6014 Whittier, CA 90609.

Associated Electrics, 3585 Cadillac Ave., Costa Mesa, CA 92626.

Robinson Racing Products, 501 Peach, Santa Ana, CA 92704.

CRP, 3250 El Camino Real B-3, Atascadero, CA 93422.

Futaba Industries, 555 W. Victoria St., Compton, CA 90220.

Thorp Manufacturing, 380 S. East End, Unit H Pomona, CA 91766.

Revtech R/C Products, 7401 White Lane, #19, Bakersfield, CA 93309.

Tekin, 930 Negocio, San Clemente, CA 92672.

TMS Products, 1948-A Del Amo Bl., Torrance, CA 90501.

Kyosho; distributed by Great Planes Model Distributors, P.O. Box 4021, Champaign, IL 61820. ■

HIGHWAY HORNET

(Continued from page 104)

age the adapter. On the axle the adapter will be held in place against the locating pin by the stock 5mm lock nut. Remember to remove the plastic hubs from the axle. To take up the extra space, use two

MRC plastic bushings and one washer between the outside of the adapter and the lock-nut. Bolt the new wheel on with two 4-40 screws. Repeat this procedure for the other side. With the 2-inch BBS wheels, the rear track is now a whopping 9.5 inches wide instead of the stock 8.375 inches.

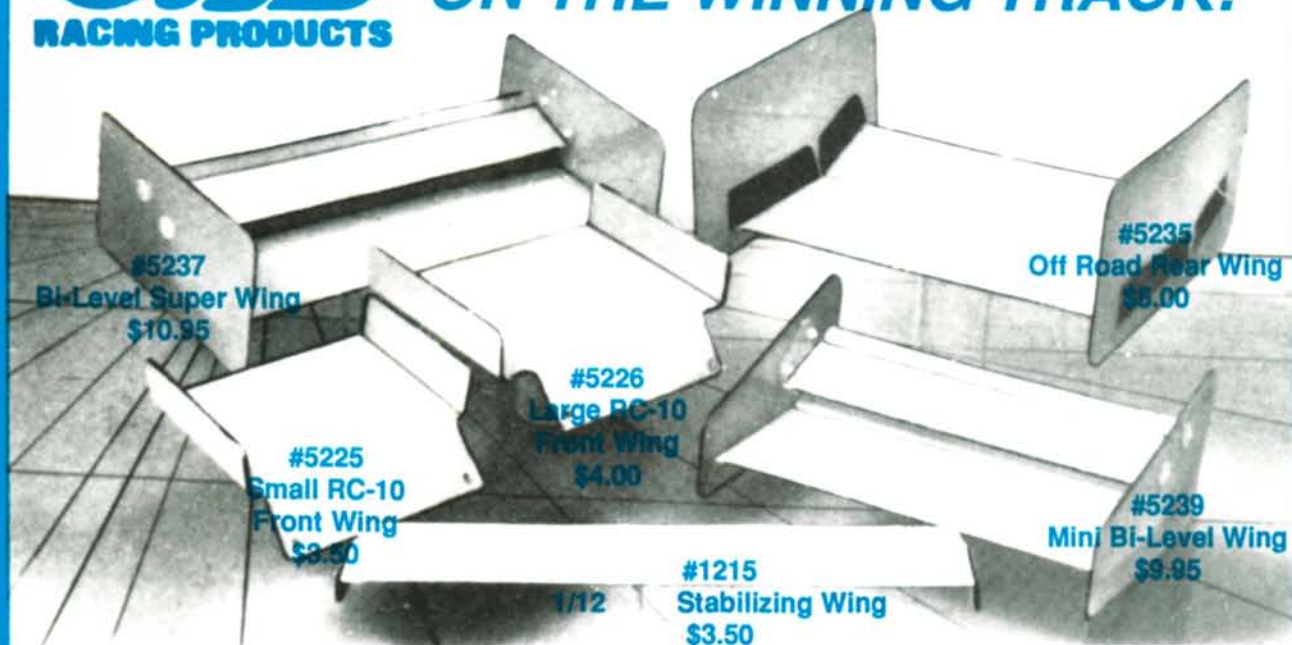
I wanted to use a sleek, aerodynamic body for my new Highway Hornet, so I chose the ASA Camaro by MRP*. Once again, master body painter and detailer Bill Henning of Henning Scale Models outdid himself. He used Pro-Cut Decals* for the numbers and sponsor. He brushed on Pactra* Outlaw Black, and sprayed on Sprint White. Details were added with Pactra's new pinstripe tapes. The front of the body was attached to the body mounts on the front bumper, while the rear fit right onto the stock body mounts. What luck! The rear wheels were sprayed with Outlaw Black for a different look.

With the body finished, it was off to the carpet roadcourse test track. Boy, did this car work! The spectators couldn't believe that there was a lowly Hornet under that sharp body. The only thing low about *this* rod was the center of gravity! The extra-wide stance made it handle like no other

(Continued on page 148)

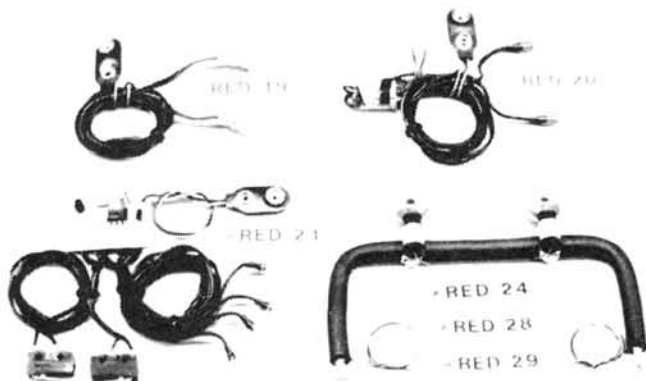
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HIGHWAY HORNET

(Continued from page 134)

Hornet I've seen. With a Novak* 4 speed control to transfer the juice to the Trinity* Monster Horsepower stock motor, I was surprised at how fast it got around the track.

If you make these changes, I think the old Hornet will amaze anyone after its transformation into a hot, on-road car. The great thing about this project is that nothing I did to the car is permanent, so it can

be returned to its stock form at anytime. So when your Hornet is running on dirt, only the two of you (you and the Hornet that is) will know what the car is truly capable of.

*Here are the addresses of the companies mentioned in this article:

Tamiya/MRC, P.O. Box 267, Edison, NJ 08818.
Parma, 13927 Progress Parkway, North Royalton, OH 44133.
AJ Products, 441 Bahr Dr., Ben Lomond, CA 95005.
TRC, Box 1058, Albemarle, NC 28001.
BoLINK R/C Cars, 420 Hosea Road, Lawrenceville, GA 30245.

MRP, 18676 142nd Ave. NE, Woodinville, WA 98072.

Pro-Cut Decals, 415 Poteet Lane, Mechanicsville, VA 23111.

Pactra, 410 N. Michigan Ave., Chicago, IL 60611.

Novak Electronics, 128-C E. Dyer Road, Santa Ana, CA 92707.

Trinity, 1901 E. Linden Ave. #20, Linden, NJ 07036.

STRETCHED OPTIMA

(Continued from page 78)

good case for one of Robinson Racing's* adjustable rear toe-in systems (2 degrees of

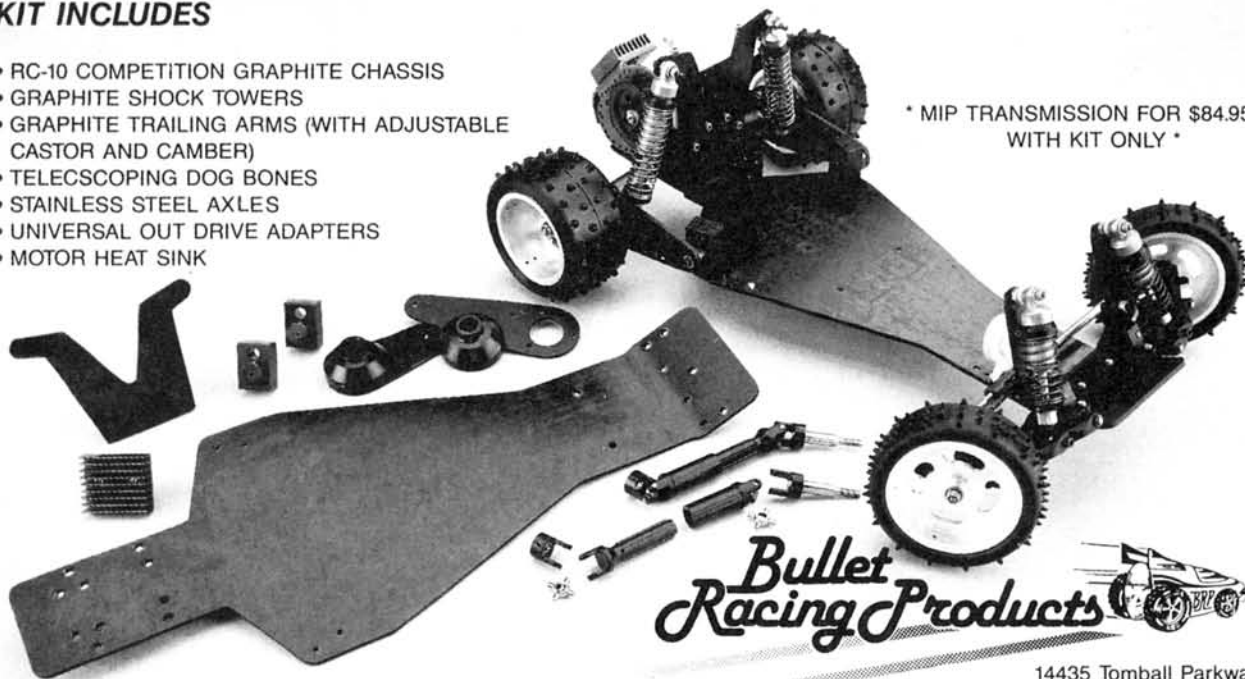
(Continued on page 150)

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STRETCHED OPTIMA

(Continued from page 148)

toe-in on my Monster Truck Mid gave me a 1-foot turning radius; I can only *imagine* what it would do for a car!).

These initial impressions held up when I took the stretched Mid out on the dirt. The car handles better in the corners, and the instability has disappeared. On jumps, the car comes down a little tail-heavy at times, but it regains traction and holds its line.

This is only the first phase of develop-

ment. Between the fiberglass chassis replacement for the metal OEM parts and the fiberglass front and rear shock mounts (also from JG) I used instead of the original metal pieces, my Mid lost about 3 ounces. And the center of gravity is 1/2 inch more to the rear than the physical center of the car. That's still as good as the original balance, and this means that most of the weight loss was lateral. Other changes should follow that example.

I know about the effect of ball and one-way differentials from my other two Mids, and I'll probably be adding them as well.

Of course, each step means more testing and more observation until the finished piece emerges. The only drawback right now is that, with the longer wheelbase and the slope of the JG body, people keep asking me why I have *Kyosho* stickers on my Cat.

**Here are the names of the companies mentioned in this article:*

Kyosho: distributed by Great Planes Model Distributors, P.O. Box 4021, Champaign, IL 61820.

JG Manufacturing, P.O. Box 6014, Whittier, CA 90609.

Robinson Racing Products, 501 Peach Lane, Santa Ana, CA 92704. ■

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TRC PRO 10

(Continued from page 100)

toe-in. The rear shock mount was set in the center locating holes, and the chassis was

checked for zero "tweak." With a good motor and a set of fresh SCRs on board, we soon had the car clicking off some pretty respectable laps. I dropped the shock to the lower holes and firmed-up the rear end a

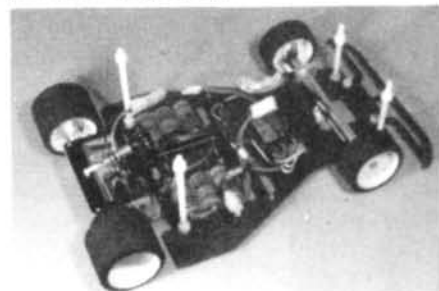
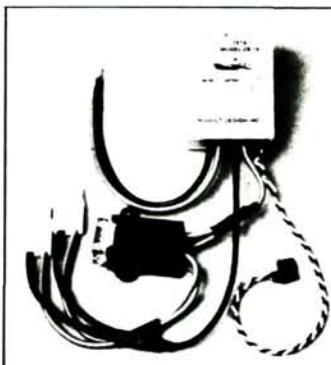
little more, and the car ran even faster. With a little caster taken out and the toe-in set at zero, the car now began to go like a rocket—definitely A-Main potential. After more experimentation with stiffness and battery placement, it became apparent that this car can be made into a screamer on just about any track.

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You might have to adopt some new driving techniques to fully exploit this racer, but it's worth the time and patience. The wide range of adjustments will allow you to tame a tough roadcourse, or set up for a monster banked-turn oval track, and this is when you begin to appreciate the work that has gone into this kit. Naturally, all tracks demand different setups, but the manual

(Continued on page 154)

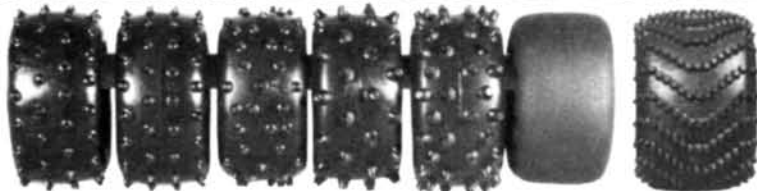
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TRC PRO 10

(Continued from page 152)

coaches you along through the process. When you do arrive at the proper combination, you'll soon be looking for the way into victory lane!

I mentioned that this car isn't an entry-level car, and I say this for several reasons: First, the detailed instruction sheet is so complicated that it will probably confuse many newcomers to this hobby, and the typos and lack of clarity in the wording will increase this confusion. The small, poorly reproduced photos don't help much either. The kit also lacked some nuts-and-bolts-type hardware, and although it's all standard stuff and easily obtainable, for the price of this kit, you should be given *all* the parts. (I hope that this was a rare oversight on the part of the manufacturer.) Everyone would benefit if the instruction manual were upgraded to meet the quality of the rest of the kit.

TRC's Pro 10 should win its share of national titles this year, and if you're ready for a top-notch on-road performer, check it out.

**Here are the addresses of the companies mentioned in this article:*
TRC, P.O. Box 1058, 2211 Charter St., Albemarle, NC 28001.

MRP, 18676 142 Ave. NE, Woodinville, WA 98072.
Floquil, Rt. 30N, Amsterdam, NY 12010.
Autographics of California, 7401 White Lane, # 1, Bakersfield, CA 93309.
Top Flite Models, 2635 S. Wabash Ave., Chicago, IL 60616.
BoLINK R/C Cars Inc., 420 Hosea Rd., Lawrenceville, GA 30245.

OPTIMA

(Continued from page 119)

1-foot drop without bouncing. The steering is positive, even over rough ground, and with its low center of gravity, the Optima corners very well with little tendency to roll over.

The Kyosho Optima is an all-purpose R/C electric car. It isn't only great for the fun-loving hobbyist who wants something to play with at the beach, but by adding a LeMans 480G motor and ball bearings, the Optima is also a serious competition machine.

**The following are the addresses of the companies mentioned in this article:*

Great Planes Model Distributors, P.O. Box 4021, Champaign, IL 61820.
Circus Hobbies, 3132 S. Highland Dr., Las Vegas, NV 89109.
Kyosho; distributed by Great Planes Model Distributors.
Tamiya; distributed by MRC, 200 Carter Dr., P.O. Box 267, Edison, NJ 08818.

VON ERICH'S GARAGE

(Continued from page 113)

and re-install the springs just the way they were before you took them off. This is a critical part of motor performance, and keeping a hot motor running at peak output depends on a little maintenance. The stock bushings will require a little lubrication, but you should use as little as possible to prevent it from getting inside the motor. Oiled brushes just ain't gonna work!

Your battery packs deserve a lot of attention, because these are usually removable and get knocked around a lot, even knocked out of the car! Many cars use the "saddle pack" arrangement, where two rows of three or four sub-C cells nest into recesses in the chassis, straddling the T-place mechanism. The cells are usually purchased loose and assembled by the modeler, and in many cases, no recommendation or instruction is given on how to do it. First, the cells must be glued together so that they fit into the chassis. The easiest way to get them into the proper chassis cutouts is by arranging them in the correct order of polarity. I've seen hot-melt glue used to fasten the batteries to one another, but I've seen the somewhat brittle adhesive come off, as it doesn't stick very well to the

(Continued on page 156)



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VON ERICH'S GARAGE

(Continued from page 154)

shrink-wrap on the cells. We've found that silicone sealant works well, and if you need to, it can be removed. It probably works so well because it doesn't dry rock-hard: Flexibility absorbs a lot of the shock imposed on this assembly, which is the heaviest individual component of your racer. Some batteries come with metal tabs on which to solder the wires, but we prefer to connect the cells with short pieces of flat-braided wire. If you can't find this

stuff in an electronics supply store, try asking for solder wicking; it's the same thing, and it's used to draw excess solder from printed circuit boards, etc. The braid is quite stiff and gives a lot of support to the battery pack, but it flexes and even stretches if it has to. Next, connect the crossover wire to join the two packs electrically. There can be a lot of current flowing through this wiring, so use wire of an adequate gauge. We use two or three pieces of 14-gauge wire in parallel, or a piece of the braid with some shrink-wrap over it. The final hookup (the wiring to the connector)

should also be heavy-duty.

I like to install an extra wire on the pre-wired connectors to add capacity and redundancy. This is easily done by removing the pins from the connector with a fine-point screwdriver pressed against the locking tabs inside the connector body. What's the sense of spending a lot of money on high-performance batteries if they can't pass the energy to the motor? The extra wiring also gives some insurance in that, if one wire breaks, there's an extra wire still attached. Now you have a rugged, depend-

(Continued on page 159)

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(Continued from page 156)

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*Here's the address of the company mentioned in this article:

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TRACK DIRECTORY

In keeping with our constant efforts to help foster the growth of the radio-control car hobby, we've decided to run this track directory intermittently to inform modelers where they can race and exchange ideas. If you'd like your track listed, send us your name, address, phone number and some information about the track to **R/C Car Action Track Directory**, 251 Danbury Road, Wilton, CT 06897. We'll list as many clubs as space allows.

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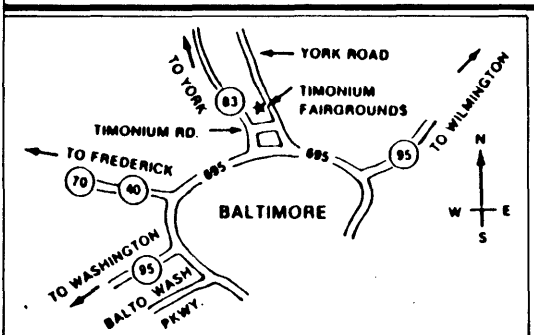
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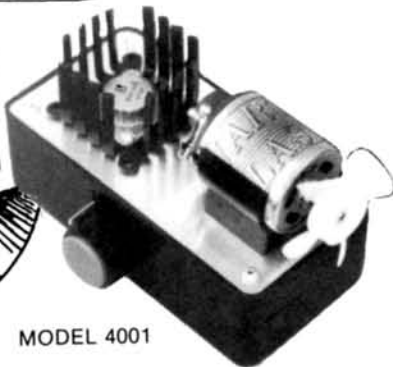
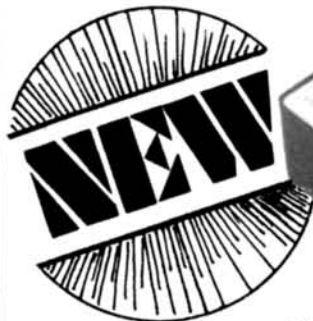
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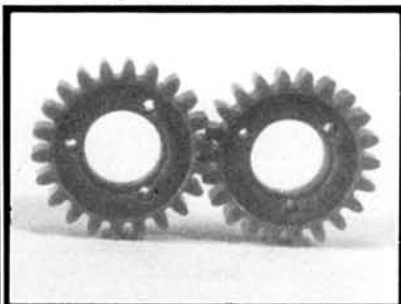
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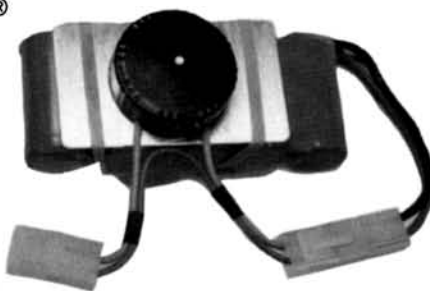
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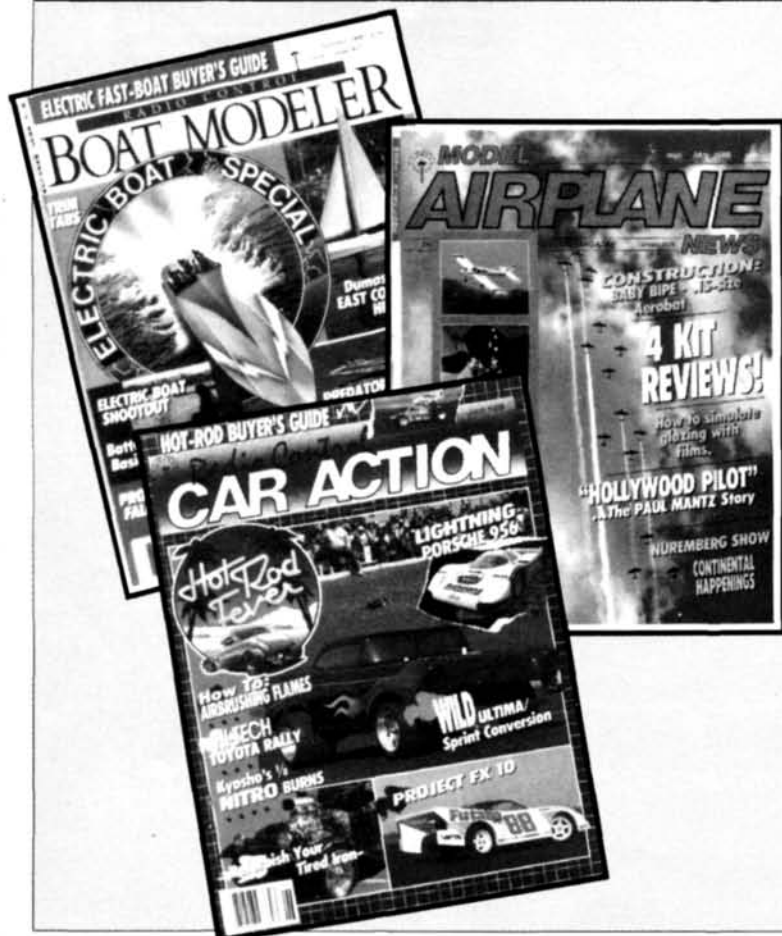
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